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Extension of the AGMEMOD model towards Russia

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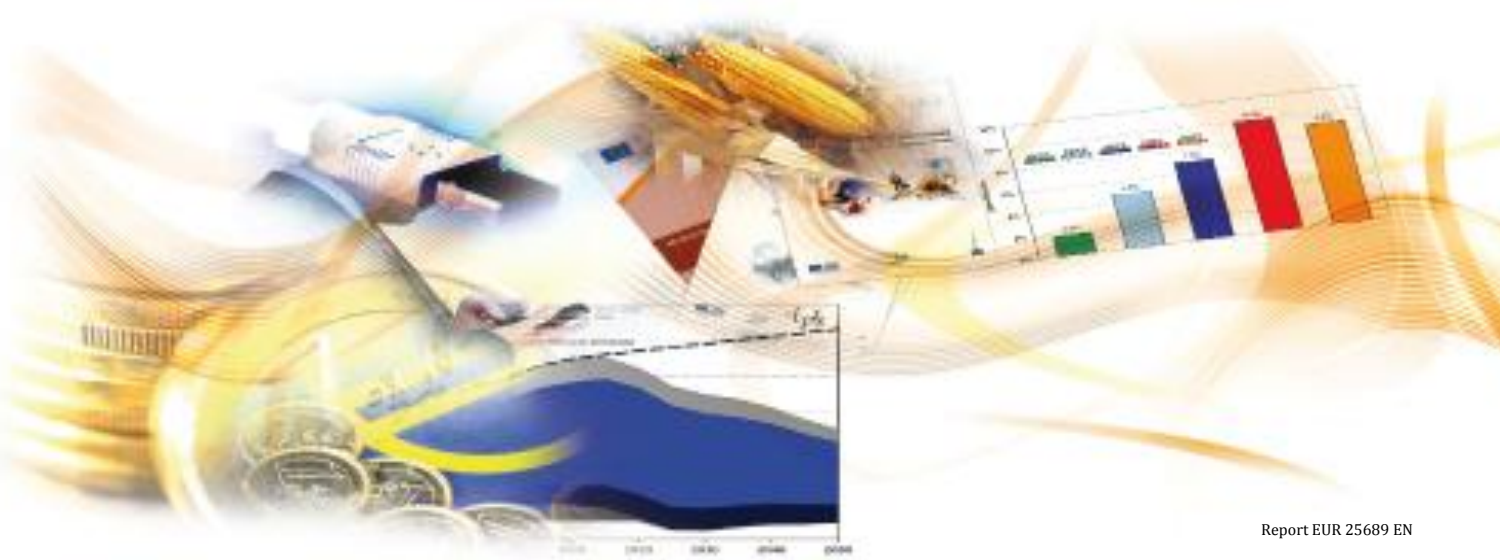

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Executive summary

Background and brief overview on the status quo of the Russian agri-food sector

The legal framework of the relationship between the European Union (EU) and the Russian Federation (Russia) is the EU-Russia Partnership and Co-operation Agreement (PCA) signed in 1994. The PCA contains special provisions regarding the economic relations between the EU and Russia, with one of its main objectives being the promotion of trade and investment as well as the development of harmonious economic relations between the two parties. Dominated by non-agricultural commodities, Russia has become the EU's third largest trading partner. In turn, the EU is Russia's major trading partner regarding both exports and imports. Russia supplies the EU with large amounts of oil and gas, while the EU exports to Russia are more diversified, covering in addition to machinery and manufactured goods also food and live animals. Since 2008 the EU and Russia are negotiating a new agreement which will update and replace the existing PCA and provide a comprehensive framework for bilateral relations.

During the transition period to a market economy, Russia's agricultural output decreased severely throughout the 1990s, especially in the livestock sector. In the 2000s, agricultural production in Russia started to rebound and the country became an important player in world agricultural markets with respect to both exports and imports. Especially grain outputs and exports increased considerably and Russia became a major supplier of grain on the world market. Even though also production in the livestock sector increased, imports of agro-food products continued to grow during the 2000s and Russia became one of the largest net importers of agro-food products. In 2010, agriculture in Russia accounted for 3.7% of GDP and 9% of total employment. During the last five years Russian agro-food exports remained stable at around 2% in total exports, while the share of agricultural imports in total merchandise imports was 16%. Russia's negative agro-food trade balance accounted for -27 billion USD in 2010, which is mostly because Russia exports bulk crops (grains, sunflower seeds) and imports high value products like meat and processed food.

Around half of the arable land in Russia is cultivated with grains and oilseeds. Due to grain market regulations intending to keep food prices low for consumers, grain areas were reduced

in 2010 in favor of oilseed areas (especially sunflower seed). Average yields per hectare in Russia are more than two times lower than average yields of cereals in the EU-27. Moreover, productivity growth is very slow. Sharp fluctuations suggest a big impact of weather variations and indicate potential for yield improvements, for example via plant protection and increased fertilizer use.

Agricultural support in Russia has been driven by the orientation of policies towards import substitution, stimulating growth of livestock production through border protection and investments and to improve agricultural efficiency. The recent food price surges have increased Russian concerns on import dependency, which was also reflected by the export ban on grains during the 2010/11 season. Since the beginning of the 2000s, one of the major agricultural policy objectives in Russia is to stimulate production in the livestock sector. The Russian government therefore supports the livestock sector with subsidies and market interventions. Throughout the 2000s, the Russian government established Tariff-Rate Quotas (TRQs) for imports of beef, pork and poultry and also imposed several sanitary-based restrictions or complete bans on imports of meat and other livestock products. Furthermore, the livestock sector benefited from the grain export restrictions imposed as responses to the surge in world food prices in 2006-08 and the grain harvest failures in 2010 caused by severe droughts. The fastest growing livestock sector in Russia is poultry, although high subsidies for pigs have increased the pork production since 2005. At the same time policy measures applied in the milk and beef sectors seem not to have substantial effects and production still tends to decrease slightly.

Market price support is mostly enacted by border measures, while input subsidies and output payments are the dominant domestic policy instruments in Russia. Applied domestic measures are mostly input subsidies, including interest rate subsidies, both at federal and regional levels. Prominent border measures are the export taxes on cereals and sunflower seed, a variable import duty for raw sugar, as well as TRQs for meat. Russia became a fully-fledged WTO member on 22 August 2012. On average, the final legally binding tariff ceiling for Russian agricultural products will be 10.8%. This is lower than the current average of 13.2%; however tariffs can continue to be applied at different levels for different products.

The modelling approach

To generate the projections for the agricultural commodity market developments in Russia until 2025 the AGMEMOD (AGricultural MEmber states MODelling) tool was used.

AGMEMOD is an econometric, dynamic, partial equilibrium, multi-country, multi-market model, initially developed to analyse European agriculture and the Common Agricultural Policy (CAP) of the EU. Based on a set of commodity specific model templates, individual models for each country are represented in AGMEMOD. The template approach allows reflecting the details of agriculture at country level and at the same time assures analytical consistency and the inclusion of all country models into a combined model.

As major part of the study the AGMEMOD model was expanded towards Russia in order to capture the developments in Russian agricultural policy and markets and their respective impact on agricultural world markets. A detailed dataset and modelling structure for the main Russian agricultural commodities has been developed. The Russian model consists of different supply and demand sub-models for those commodities that represent the majority of the agricultural output in Russia. In general, cereal and oilseeds with their derived products (oils and cakes), sugar beet, potatoes, livestock (cattle, beef, pig meat, poultry, sheep and goats), and dairy products (raw milk, butter, milk powder and cheese) are represented. For each of these commodities, production as well as supply, demand, trade, stocks and domestic prices have been derived by econometrically estimated or calibrated equations. Furthermore, detailed data sets of agricultural policy instruments such as input subsidies, direct payments, support prices, import tariffs, and export duties have been developed for the Russian model.

To ensure that the baseline projections of the Russian AGMEMOD model make economic sense and are coherent from a policy perspective, they have been validated by standard econometric methods and by AGMEMOD partners familiar with agricultural policy and markets in Russia. From this perspective, the performance of the Russian commodity market models in determining the baseline projections had primacy in the evaluation of the modelling system's performance.

Projections of Russian agricultural commodity markets until 2025

The market outlook presented in this report is a model based projection of the future development of main agricultural commodity markets in Russia until the year 2025 with endogenous formation of world market prices. The projections are based on a set of coherent macroeconomic and policy assumptions. Moreover, the projections assume normal weather conditions and steady demand and yield trends following recent time paths. Thus no disruptions, for example caused by bad weather conditions, are considered. Therefore the projections show rather smooth developments, whereas in reality it is very likely that the markets move along more volatile paths. As the projections for yields follow recent time

paths, a substantial increase in the use of inputs like fertilizers and pest management is not considered (even though in reality this could significantly increase yields in Russia's agricultural production). For the projections a status quo policy environment is assumed, i.e. applied and scheduled agricultural domestic and trade policy instruments in Russia continue up to the projection year 2025. International trade is governed by the Uruguay Round Agreement on Agriculture (URAA), and Russia will not apply any export or import bans during the projection period. However, it is assumed that Russia continues to protect its domestic agricultural sector via import tariffs, tariff rate quotas, export quotas and export taxes (i.e. the WTO commitments for Russia are not taken into account and entry effects will be evaluated in another publication). Thus, the baseline situation for Russia is mainly defined by:

- macroeconomic projections for Russia according to current knowledge;
- continuation of specific Russian agricultural policy and trade instruments as currently applied and scheduled;
- continuation of the specific Russian consumer support in a stylized approach;
- domestic prices for the Russian markets linked to the world market;
- normal weather conditions and steady demand and yield trends (following recent time paths).

In the following the projection results for the Russian agricultural markets until 2025 are briefly presented by sector.

Cereals and oilseeds markets:

- Prices in Russia for all cereals and oilseeds are projected to remain below their respective world price levels as the Russian grain market is assumed to continue to be driven by state purchasing and selling of intervention stocks. Therefore Russian cereal and oilseed markets will remain partly separated from the world markets. However, due to increasing internal demand for arable crops the domestic prices are also projected to increase and the differential to diminish.
- Projections show a shift from the area planted with cereals to oilseeds area, driven by stronger demand for oilseeds and less governmental influence in oilseeds than in cereals production. Because of similar requirements concerning soils, wheat is projected to be affected most.
- Growth in yields per hectare is projected to be small as relatively low producer prices limit the incentives for input use.

- Although self-sufficiency rates decline in the course of the projection period, Russia is expected to remain self-sufficient for the main cereals as well as for sunflower seeds and rapeseeds. The downward trend in the self-sufficiency rate for cereals is attributable to both the projected decrease in area planted and the increase of domestic demand for feed especially of wheat and barley. Nonetheless, Russia is projected to retain a relatively strong export position for cereals and sunflower seeds and oils.

Other crops:

- Russian prices for potatoes are projected to remain significantly above EU and world market prices, while sugar prices are projected to stay below the EU price but above the world market price. In both cases the gap between the EU and Russian prices is declining. To fulfil the state plan to achieve self-sufficiency with sugar the higher sugar prices guarantee development to that direction.
- Projection of yields for sugar beets are, compared to all other crops, remarkably high which induce a considerable increase in the Russian self-sufficiency, so that Russia will become self-sufficient for sugar beets from 2015 onwards.
- Russia is projected to remain self-sufficient with potatoes, however potatoes are mostly produced for own consumption.

Livestock and meat:

- Supply shortage and increasing demand keep Russian pork prices above the world market price and induce a rise above the EU price. This price development is enabled by border protection. Russian beef prices are not expected to reach EU level, however to remain significantly above world market prices. Domestic price increases in poultry are projected to be limited due to the increase in production, and domestic poultry prices remain below the EU price level and close to the world market price level.
- The beef baseline projections depict a further decrease in Russia's beef production, and as at the same time domestic use is expected to increase, Russia's net-trade position further deteriorates over the projection period.
- Pork production is expected to further grow during the projection period, but at a lower rate than pork consumption. As a result, Russia's net imports of pork are projected to increase.
- Poultry production continues its increasing trend of the last decade also over the baseline period. With production growing at a faster rate than consumption, Russia is projected to further improve its position as a net-exporter of poultry.

- With the exception of poultry, Russia is projected to remain a net importer of all kinds of meat despite the import tariffs, tariff quotas and subsidies for animal products applied. Income growth drives consumption per capita of all meats to increase, with the strongest growth projected to take place in pork consumption.

Milk and dairy products:

- In the baseline projections, Russian prices of milk exceed the EU prices and the same holds true for skimmed milk powder and cheese. However, in the case of butter, Russian prices and EU prices are relatively close. Driven by strong demand based on economic growth, milk and dairy prices increase, especially in the second half of the projection period.
- Despite the high prices and additional domestic support, milk production is projected to remain insufficient over the projection period due to a low productivity level. As a consequence, Russia is projected to remain a net importer of dairy products.

Russia is a member of the WTO since 22 August 2012. However, the simulations for the outlook have been conducted in the beginning of 2012 and therefore Russia's accession to the WTO and the associated commitments are not taken into account. Accordingly, for the baseline projections the Russian border policy applied to protect Russian agriculture - which reflects a package of import tariffs, export quota and export taxes - is assumed to be applied unchanged up to 2025. How does the WTO agreement affect our projections of the Russian agricultural outlook? First results of a WTO accession scenario conducted with the AGMEMOD model indicate that the WTO commitments might especially affect prices in the livestock sector of Russia. As Russia will have to lower its market interventions in the livestock sector this is projected to result in lower production increases in the sector and augmented meat imports (especially pork). Lower livestock production in Russia implies lower domestic demand for feed grains which is projected to have also impeding effects on the production growth in Russia's grains sector; however grain exports are projected to increase.

It also has to be pointed out that results of the latest OECD-FAO (2012) agricultural outlook are generally far more optimistic than our projections with regard to growth in Russia's agricultural production. In our projections, growth in agricultural production follows recent time paths and in recent years Russia's cereal sector was negatively affected by several domestic policy interventions which limited exports. These policy interventions constituted a

disincentive for Russia's cereal producers, provoking a shift from cereals to oilseeds production (as in the latter no or at least less, policy interventions took place). This trend is carried forward throughout the projection period. Consequently our projections might be rather conservative with respect to production increases. As outlined throughout the report, Russia has considerable potential for agricultural production and growth, and our projection results would certainly be altered if Russia is able to solve some of the underlying problems that limited the development of its agricultural sector in the recent past.

Content

List of Tables

List of Figures

1. Introduction

1.1 Background

The legal framework of the relationship between the European Union (EU) and the Russian Federation (further in the report Russia) is the EU-Russia Partnership and Cooperation Agreement (PCA) signed in 1994. The PCA contains special provisions regarding the economic relations between the EU and Russia and one of its main objectives is the promotion of trade and investment as well as the development of harmonious economic relations between the two parties.[1] Since 2008 the EU and Russia are negotiating a new agreement which will update and replace the existing PCA and provide a comprehensive framework for bilateral relations (EU Delegation to Russia, 2012).

Dominated by non-agricultural commodities, Russia has become the EU's third largest trading partner (ranked 2nd with regard to imports and 4th regarding exports). About 11.7% of EU imports originate from Russia, whereas 7.1% of total EU exports go to Russia. In turn, with a share of 49.4% of total exports and 43.1% of total imports, the EU is Russia's major trading partner regarding both export and imports. Russia supplies the EU with large amounts of oil and gas, while the EU exports to Russia are more diversified, covering in addition to machinery and manufactured goods also food and live animals (DG Trade, 2012).

During the transition period (1991-1999) after the breakup of the Soviet Union, Russia experienced a sharp decline in its economic performance. Russia's economy started to recover after the peak of a financial crisis in 1998. Between 1999 and 2008 Russia was one of the fastest growing economies in the world, with an average annual GDP growth of more than 7%, until it was hit hard by the global economic crises in 2008. In 2009 Russia's GDP contracted by 7.8%, but in 2010 the Russian economy begun a modest recovery, supported by government anti-crisis policies, the global economic rebound, and a rise in oil prices, and in 2011 GDP growth was

[1] For more specific information on the EU-Russia PCA see: http://trade.ec.europa.eu/doclib/docs/2003/november/tradoc_114138.pdf

4.3%[2]. In total, Russia is a net exporting country, with 70% of its export in 2011 being mineral products while the major part of the imports (48%) was machinery. Mining and processing industry comprised 26.7% of GDP in 2011. Real GDP per capita (in prices of 2000) in Russia was 2087 EUR in 2011 and the number of population adjusted according to the last census data was 142.9 million (i.e. population decreased by 3% during the last decade).

Figure 1: Map of the Russian Federation

Source: CIA World Factbook (2012)

In 2010, developments in Russia demonstrated its importance for the international cereal and oilseed markets. Due to forest fires and a record drought, Russia lost one third of its crop harvest, as around 10 million hectares of agricultural land were either burned or devastated by extreme weather conditions. As a consequence, the country put a ban on grain exports starting on August 15, 2010 and lasting until July 2011. Exports from Russia to the EU are normally handled within quotas, and therefore direct impacts of the export restrictions on the EU domestic cereal markets were limited. However, it is assumed that the bans added to instable world grain markets and drove up world grain prices (Anderson and Nelgen, 2011, Sharma, 2011). Thus, the EU was at least indirectly affected by the grain export restrictions of its neighbouring country Russia. In 2012 drought affected again more than 7% of sown area (5.5 million hectares) in Russia, and

[2] Here and where not mentioned other, the data source is the Federal State Statistics Service of Russia

emergency situation has been pronounced in 20 regions mostly in the European part of Russia and the southern part of the Siberian District (MoA of Russia, 2012).

Due to the importance of Russia's agricultural sector, the AGMEMOD (AGricultural MEmber states MODelling) tool was expanded towards Russia in order to capture the developments in Russian agricultural policy and markets and their respective impact on agricultural world markets. AGMEMOD is a modelling tool designed to analyse European agriculture and the CAP. With respect to the needs of the European Commission for market and policy analysis, this model covers all EU Member States with the exception of Malta. Moreover, AGMEMOD was previously updated to incorporate candidates and potential candidates to EU accession. The AGMEMOD 4.0 version incorporates models for the western Balkan EU candidate countries Croatia and the Former Yugoslav Republic of Macedonia (Erjavec et al., 2007; van Leeuwen et al., 2007a; van Leeuwen et al., 2007b; Salputra et al., 2008; Chantreuil et al. 2011), and Turkey (van Leeuwen et al., 2011). Furthermore, in the AGMEMOD 5.0 version the model was updated to incorporate also Ukraine (Leeuwen et al., 2012).

This report provides an overview on the agricultural sector and policy as well as an outlook on the developments in agricultural markets for Russia, focussing on the main agricultural commodities, which are:

- cereals (soft wheat, barley, maize, rye, oats, other grains);
- oilseeds (rapeseed, sunflower seed, soybeans, plants oils and meals);
- livestock and meat (beef and veal, pork, poultry, sheep and goats);
- milk and dairy products (butter, milk powders and cheese).

Commodity balance items such as production, domestic use, stocks, exports, imports as well as the associated prices are projected and simulated to a 15 year time horizon, with the underlying quantitative and qualitative assumptions on macroeconomic and other variables reported.

1.2 Data sources and structure of the report

Various data sources have been used for the agricultural commodities covered in this report. To build the database for the Russian AGMEMOD model the data sources indicated in Table 1 have been used. They also build the basis for the overview on the agricultural sector given in chapter 2 as well as the agricultural market outlook presented in chapter 4.

Table 1: Data sources for commodities modelled in the AGMEMOD model for Russia

Commodity groups	Data Sources for Russia
Cereals and oilseeds	Federal State Statistical Service; Pro Zerno; Agribusiness Information Consulting Company APK-Inform; Ministry of Agriculture of Russian Federation; FAPRI; USDA FSS
Vegetable oils and meals	Federal State Statistical Service; Pro Zerno; Agribusiness Information Consulting Company APK-Inform; Ministry of Agriculture of Russian Federation; FAPRI; USDA FSS
Root crops (potatoes and sugar beet)	Federal State Statistical Service; Ministry of Agriculture of Russian Federation
Cattle, pigs, sheep; beef, pork, sheep meat, poultry, eggs; milk and dairy products	Federal State Statistical Service; Ministry of Agriculture of Russian Federation

The report is structured as follows: chapter 2 provides an overview on the Russian agricultural and food sector, comprising information concerning the role of agriculture in the Russian economy, basic information on Russian agricultural and trade policies, some details on the agricultural production structure as well as main developments of the past and the status quo of Russia's agricultural production and trade. The baseline settings for the Russian agricultural market outlook are outlined in chapter 3 and the results and analysis of the baseline simulations for Russia are presented in chapter 4. The final chapter 5 provides conclusions and qualifications for further research. The Annex presents mathematical equations of the modelling approach.

2. Overview on the Russian agri-food sector

This chapter provides a brief overview on the agri-food sector in Russia. The role of agriculture in the Russian economy is described in section 2.1. Basic information on Russian agricultural and trade policies is given in section 2.2, followed by some details on the agricultural production structure in Russia (section 2.3). The main developments of the past as well as the status quo of Russia's agricultural production and trade are outlined in section 2.4. Section 2.5 highlights briefly some issues of productivity and competitiveness and the developments of consumer prices and food consumption in Russia are described in section 2.6.

2.1 The role of agriculture in the Russian economy

Russia is a huge producer of agricultural commodities, and its agricultural output has steadily recovered after a deep recession in the 1990s. However, as non-agricultural sectors grew more rapidly, the share of agriculture in total GDP in Russia decreased from 14.3% in 1991 to 4% in 2011. Furthermore, the agricultural sector accounted for 9% of total employment in 2010. Table 2 provides an overview on the main agricultural indicators in terms of agricultural production, land, labour and capital in Russia. Russia became a large wheat exporter in the 2000s, but it is also one of the largest agro-food importers and runs a considerable deficit in agro-food trade (about -27.1 billion USD in 2010), especially in meat and dairy products (cf. Liefert et al., 2009). In percentage terms agriculture's export share in total export remained stable at a level of around 2% during the last five years, while the share of agricultural imports in total merchandise imports was 16%. Two thirds of Russia's agri-food export and 83% of import is to/from non-CIS countries.

Table 2: Agricultural indicators for Russia, 2010

Agricultural land (million ha)	190.8
Share of agricultural land in total area (%)	11.1
Labour use (1000 person)	6100
Share of agricultural labour in total labour (%)	9.0
Share of agricultural GDP in total GDP (%)	3.7
Agricultural production value (million USD)	86 248
Gross value added in agriculture (million USD)	46 802
Value of capital assets in agriculture (million USD)	94 200
Agri-food export value (million USD)	9 400
Agri-food import value (million USD)	36 500
Share of agri-food export in total merchandise export (%)	2.2
Share of agri-food import in total merchandise import (%)	15.9

Source: Federal State Statistics Service (FSSS) of Russia, own calculations

In 2010 more than 43 thousand enterprises were operating in food processing, employing 1.3 million people. However, the number of enterprises and employees is constantly decreasing. Profitability of sold processed production was 11%. The share of food processing in total processing industry in 2011 was 16.2%, and production is still around the level of 1991. Use of production capacity is low and varied from 29-65% for grain products up to 82% and 89% for poultry and sugar respectively.

Investments in fixed capital within the agricultural sector were 10.1 billion USD in 2010, which is 3.3% of total investments in the national economy of Russia. Most investments occurred in corporate farming, where about 43.2% of the investments were allocated to production buildings and 36.4% in machinery and technological equipments. Financing of investments was shared by own financial means (49%) and by external means (51%).[3]

Foreign investments in agriculture and forestry in 2011 were 638 million USD (with 417 million USD being direct investments), which was 0.3% of total foreign investments in Russia. Foreign investments in food processing were 3099 million USD (1.6% of the total). Accumulated foreign investments in agriculture and forestry at the end of 2011 were 2152 million USD (1575 million USD being direct investments), comprising 0.6% of the total accumulated foreign investments. Foreign investments accumulated in food processing were 12812 million USD (8164 million USD direct), i.e. 3.7% of the total.

[3] For an empirical analyzes on investment behaviour of Russian farms see for example Bokusheva et al. (2009).

2.2 Agricultural policy instruments

Due to the collapse in state revenues in Russia, support transfers to agriculture fell from 10% to 4% of the GDP from 1992 to 1993 and even to 2% in 1994. Support to agriculture dropped again significantly in 1999 and 2000 because of the financial crisis, but rebounded in the period 2001 to 2005 and increased even more with the launch of a two-year National Priority Project for Development of Agro-Industrial Complex in 2006. Main priorities of this project were meat and milk production and improvement of small scale farm production. Firstly, the project was aimed to increase the meat and milk production by 7% in 2006 and by 5% in 2007 through the provision of subsidized loans to livestock industries. Secondly, loans, technical assistance and a better infrastructure were to encourage smaller farms to increase their output by 6%. The credit policy of the government aimed to help both individual farmers and large privatised corporate farms. The Priority Project was succeeded by the State Programme for Development of Agriculture for 2008–2012, which is the major framework for establishing measures of agricultural support in Russia.[4] Its main objectives are the improvement of competiveness, enhancement of rural development and resource conservation. The State Programme indicates a significant increase in public spending for the sector, comprising 551 billion RUB from the State Federal budget, 544 billions RUB from regional budgets, 311 billion RUB from non-budget sources. The expected results include an increase of agricultural production by 24.1% compared to 2006 and an increase of the country's food self-sufficiency rate up to 70% (accounted at wholesale level). The State Programme has three subprograms: i) Sustainable development of rural territories; ii) Establishing of conditions for functioning of agriculture; iii) Development of priority sectors in agriculture. The priority livestock sectors are pedigree breeding, reindeers, horses, sheep and goat. As priority crop sectors, elite seeds, flax, rapeseed, and wine have been determined. The focus of state support is on improving agricultural efficiency, and putting more assistance into capital and technological improvements. A specifically targeted funding programme for the development of poultry production in Russia in 2010-2012 has been launched as well. This programme is mostly devoted to building new plants, however, for subsidies to cover costs of investment interest payments and poultry breeding 1003 million RUB and 384

[4] The current State Programme expires in 2012 and will be succeeded by a new one for 2013-2020 (cf. Vassilieva, 2012).

million RUB have been reserved accordingly as well (MoA of Russia, 2008; OECD, 2009; OECD, 2011)[5].

Agricultural support in Russia is driven by the orientation of policies towards import substitution, stimulating growth of livestock production through border protection and investments and to improve agricultural efficiency. The recent food price surges have increased Russian concerns on import dependency, which was also reflected by the export ban on grains during the 2010/11 season. However, the export ban had not only spill-over effects on international markets but also acted as a disincentive for domestic grain producers. According to the OECD, Russia's stated policy objectives are pursued at relatively high costs for Russia's taxpayers and consumers, and also transfers from the crop to the livestock sector. Furthermore, the majority of agricultural policy support in Russia is provided through output and variable input subsidies, and hence in the potentially most distorting forms (OECD, 2011).

One of the most important agricultural support measures in Russia are concession credits, which are paid in the form of subsidies on interest payments and are co-financed from federal and regional budgets. The subsidy rate depends on both the type of beneficiary and loan, and it is estimated that in the period 2007-2010 the interest rate for concessional loans was reduced by about two thirds through the subsidy (OECD, 2011). Regarding tax preferences, agricultural producers (i.e. farmers and enterprises which's agricultural output comprises at least 70% of total output) can choose between two schemes of tax payments. If they choose the Single Agricultural Tax (SAT) regime, they have to pay a unified tax of 6% on their net income (the difference between the value of gross receipts and expenses), but they do not have to pay income tax, property tax, Single Social Tax, and apart from specific cases neither VAT. Agricultural organisations not opting to pay the SAT are benefitting from a zero income tax on earnings from primary agricultural and processed products. Additionally to SAT related concessions there are also other VAT preferences that are related to agro-food items. For live cattle and poultry a reduced VAT rate of 10% is applied (compared to a standard 18% rate) and the same preferential VAT rate is applied to various other key foodstuffs (OECD, 2011).

[5] For the regulatory and administrative framework for agricultural policies in Russia see also OECD (2009) and USDA FAS (2012).

The most important border measures are the export taxes on oilseeds, import tariffs, as well as tariff rate quotas (TRQs). Meat and meat products are the largest import group, where imports from the non-CIS area are being subject to TRQs. At the same time Russia restrains deliveries from some suppliers due to food safety reasons and in connection with animal disease. Before 2010 most of the TRQs were allocated based on a country principle, but since 2010 the Russian authority that manages the quota allocation has the option to re-allocate country-specific meat quotas to other suppliers, and since 2011 the country principle is no longer applied to the poultry quota (OECD, 2011).

While the national economy of Russia is growing on the basis of a strong international demand for energy and other national resources (resource-based growth), the energy boom has also resulted in a sharp increase of fuel costs. To deal with the growing costs producers face, the government has introduced a subsidy for this input. An important policy mechanism in Russia is also state market intervention. There are two instruments of market interventions – purchasing interventions and product (selling) interventions. These campaigns are organised in order to regulate grain markets and therefore called as ’grain interventions‘. Objective of interventions are not providing support to grain producers or forming state reserves, but rather regulating grain market prices. Since November 2001 until 2010/11 there were five purchasing interventions (in 2001/02, 2002/03, 2005/06, 2008/09 and 2009/10) and three product interventions (in 2003/04, 2007/08 and 2010/11). The intervention fund is to be sold out in the years of high prices. To keep the effect of product intervention, they are accompanied by export taxes and in 2010, following the drought and fires, even by a ban on grain exports (covering wheat, barley, rye, maize, wheat flour and mixed wheat and rye flour).

In 2009 the state owned ’United Grain Company‘ (UGC) was established by the Russian government, which’s official functions include increasing the state’s involvement in the domestic grain market, improving the infrastructure of Russia’s grain markets and grain marketing. Among other functions, the UGC also acts as a government agent in the government grain interventions. In May 2012, the UGC was partly privatized as one of the largest Russian private investment holding companies, Summa Group, purchased 49% of its shares (cf. USDA FAS, 2012b).

Conway et al. (2009) used OECD's indicators of product market regulation to assess the extent to which the regulatory environment in Russia supports competition. They suggested that Russia's economic performance would greatly benefit from a reduction in the role of the state enterprise sector in markets and from reinvigorated efforts to liberalise foreign trade and direct investment regimes.

Table 3: Border and budgetary payment measures of Russian agricultural policy in 2010

Policy instrument	Agricultural sector where the instrument is applied
Direct payments (per tonne, per ha, per animal)	Poultry, sheep, pigs, rape seed, flax
Input subsidies (fuel, seeds, fertilizers)	Crops
Credit support	Various sectors
Intervention purchases	Cereals
Import duties (Euro/kg)	Beef, pork, poultry
Import tariffs (% rate)	Pork, poultry
Quota tariff rate (tonnes)	Beef, pork, poultry, sugar
Export duties	Cereals
Export quota (tonne)	Cereals

Source: OECD, WTO, World Bank.

Russia became a fully-fledged WTO member on 22 August 2012. On average, the final legally binding tariff ceiling for Russian agricultural products will be 10.8%. This is lower than the current average of 13.2%; however tariffs can continue to be applied at different levels for different products. The final bound rate was implemented on the date of accession for more than one third of national tariff lines and another quarter of the tariff cuts have to be put in place three years later. The longest implementation period is eight years for pork. Tariff rate quotas will be applied to beef, pork, poultry and some whey products. All agricultural export subsidies will be bound at zero. It was also agreed that quantitative restrictions on imports (such as quotas or bans) that cannot be justified under the WTO provisions, have to be eliminated and not (re)introduced (WTO, 2011).

2.3. Production structure

In this subchapter some issues regarding Russia's regional structure and farm structure are briefly outlined.

Regional structure

The Russian Federation comprises eight federal districts: Central with headquarter in Moscow, Southern with headquarter in Rostov-on-Don, North-western with headquarter in Saint Petersburg, Far Eastern with headquarter in Khabarovsk, Siberian with headquarter in Novosibirsk, Urals with headquarter in Yekaterinburg, Volga with headquarter in Nizhny Novgorod and North Caucasian (the Federal district which was newly created since 1 January 2010 dividing the Southern region) with headquarter in Pyatigorsk. Agriculture is concentrated mostly within the European part of the country and the Siberian district. Northern areas concentrate mainly on livestock, while grain is mostly produced in the southern parts of the country, as well as western Siberia. Volga, the Central, the Southern Federal and the Siberian districts produce about 90-95% of the total agricultural production value, and also 90% of total sown area is located in these regions. Thus, Russian agricultural production is located in areas with the highest population density (68% of total Russian population lives in these four regions) close to local consumers and (with the exception of the Siberian district) in a rather short distance from the EU Common Market.

As regards market connections between different regions within Russia, the analysis of the spatial pattern of goods market integration suggests that most of the regions are integrated, with only about one-fifth of Russia's regions appearing as not integrated and showing no tendency towards integration (Gluschenko, 2011).

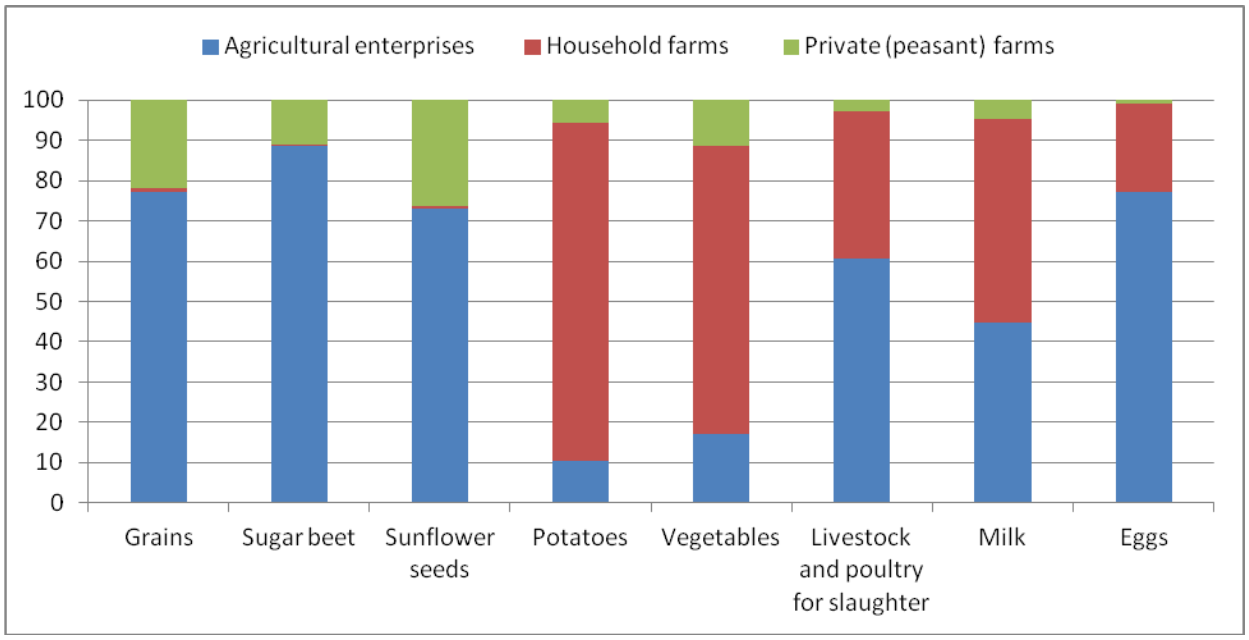
Farm structure

Russia is characterized by a dual farm structure with large-scale farms existing along with small units. The current Russian agriculture sector is characterized by three main types of farms: large farm enterprises (corporate farms) with various derivate farming companies, household plots and peasant (family) farms. Corporate farms (in form of collective or state farms) and household plots already existed during the Soviet period, while the peasant farms began to emerge only during the post-Soviet transition. Since the end of the 1990s, the emergence of a new

organisational form of farming could be observed in Russia within the farm type of corporate farms. The so-called agroholdings are very large commercial farming operations and can be seen as a combination of a new organization of the vertical supply chain and farming, and they are especially shaping the landscape with respect to Russia's grain production output. Furthermore, vertically integrated enterprises can also be found in Russia's poultry and pork industry.[6]

In 2010, corporate farms have produced 45% of agricultural production value, household plots 48%, and peasant farms 7%. Peasant farms contributed to 22% of Russia's total grain production compared to 6% in 1997, 26% of sunflower seed compared to 11% in 1997 and 11% of sugar beets compared 4% in 1997. In contrast, household plots produced 84% of the country's potato supplies and 71% of the vegetable supplies, either for on-farm consumption or for local market sales. In the animal sector, the household plots produced 50% of total milk and 39% of total meat, with the rest coming mainly from corporate farms whereas the contribution of peasant farms was negligible (cf. Figure 2).

Figure 2: Production of basic agricultural products by types of farms, 2010 (% of total production volume)



Note: Peasant farms include individual entrepreneurs; Grains = weight after processing; Livestock and poultry for slaughter = slaughter weight.
Source: FSSS

[6] For detailed information on (the development of) farm structure and agroholdings in Russia see for example Lerman et al. (2004), Zimmermann (2004), Rylko and Jolly (2005), Lerman and Shagaida (2007), Serova (2007), Hockmann et al. (2009), Koester and Petrick (2010).

2.4. Agricultural production and trade: past developments and status quo

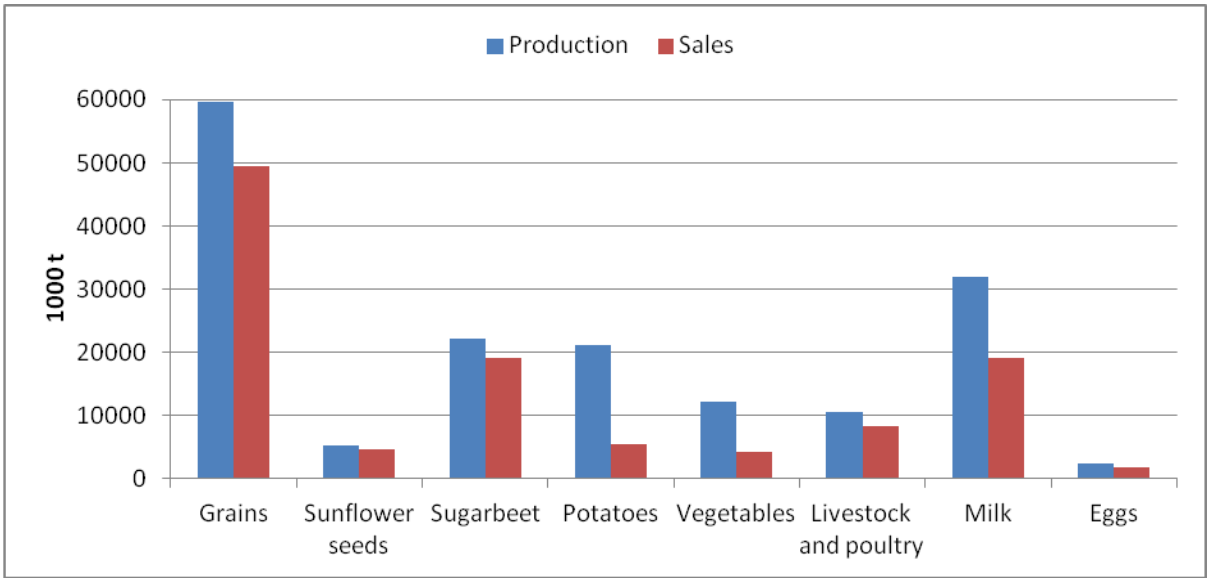
During the transition period to a market economy, Russian agricultural output decreased severely throughout the 1990s, especially in the livestock sector. The main reason for this was that the broad subsidies that the sector received during the time of the Soviet Union were substantially reduced or eliminated. As a result, agricultural output contracted by almost two-fifth in the 1990s. Agricultural production started to rebound in the 2000s, and agricultural output increased by one-third. Especially the grain sector recovered substantially and Russia became a large grain exporter from the mid 2000s onwards.

This section presents a brief overview on the past developments and the status quo of agricultural production and trade in Russia. Some information on the share of market sales in total production is given in section 2.4.1, followed by information on production, net trade and price developments in the Russian crop (section 2.4.2) and livestock (section 2.4.3) sectors.

2.4.1. Production and market sales

On-farm use of production and household consumption play an important role in livelihood in Russia. The situation also reflects that small household plots still play an important role in the livestock and dairy sectors. Regarding the share of agricultural products delivered to market in 2010, the highest shares of market sales were for sunflower seeds and sugar beets (each 86% of total production) and for grains (83%). In the livestock sector the shares of market sales show increasing trends, with the share being up to 80% for meat and 60% for milk in 2010. The lowest share of market sales are those for vegetables and potatoes, with 35% and 26% respectively.

Figure 3: Production and sales of agricultural products in Russia, 2010

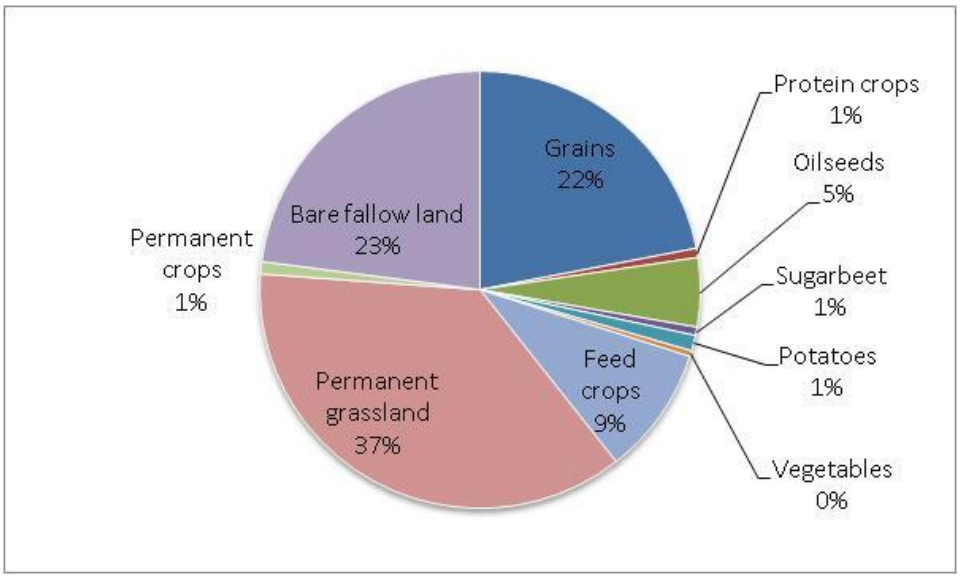


Source: FSSS

2.4.2. Crop sector

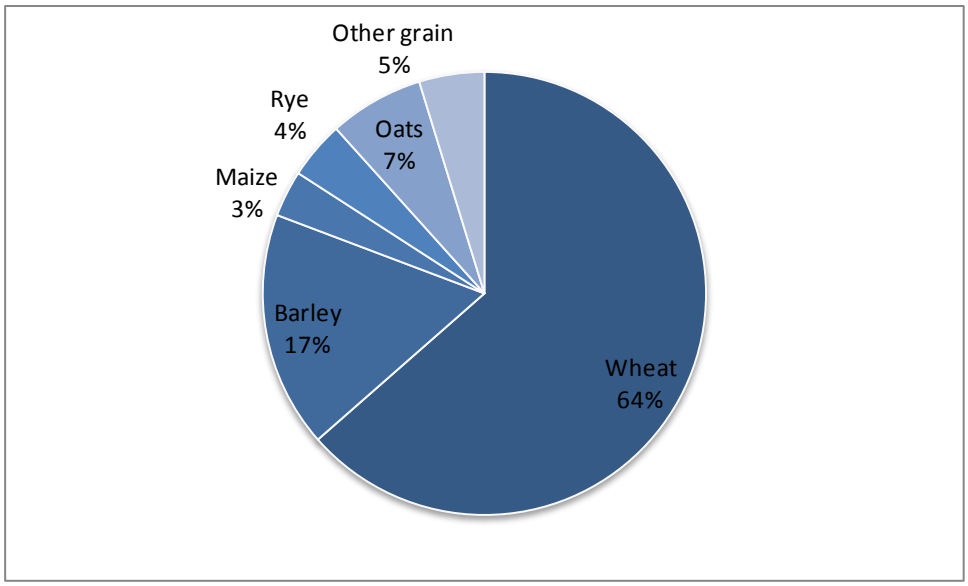
In Russia the main factor of agricultural production – agricultural land – is available at a level of 190.8 million hectares, however, this is only 11% of the total territory. Around one-fourth is cultivated with grains and more than one-third is covered by permanent grassland. Due to the regulated country's grain market intending to keep food prices low for consumers, grain areas were reduced in 2010 compared to 2009, while oilseed areas increased. In terms of area allocated, the most important grains are soft wheat and barley. The main oilseed is unambiguously sunflower seed. During the last decade land allocation for oilseeds doubled. At the same time Russia has a huge potential of arable production, as 23% of all agricultural land is bare fallow land. However this fallow land is normally situated in the remote areas without proper road infrastructure. Thus, the involvement of this fallow land into agricultural production seems very difficult unless massive investments into road infrastructure would be provided. Furthermore, much of the fallow land became wild with shrubs and bushes, and hence more investment would be required to return it to agricultural use.

Figure 4: Agricultural land use shares in Russia, 2010



Source: FSSS

Figure 5: Composition of grain area in Russia, 2010

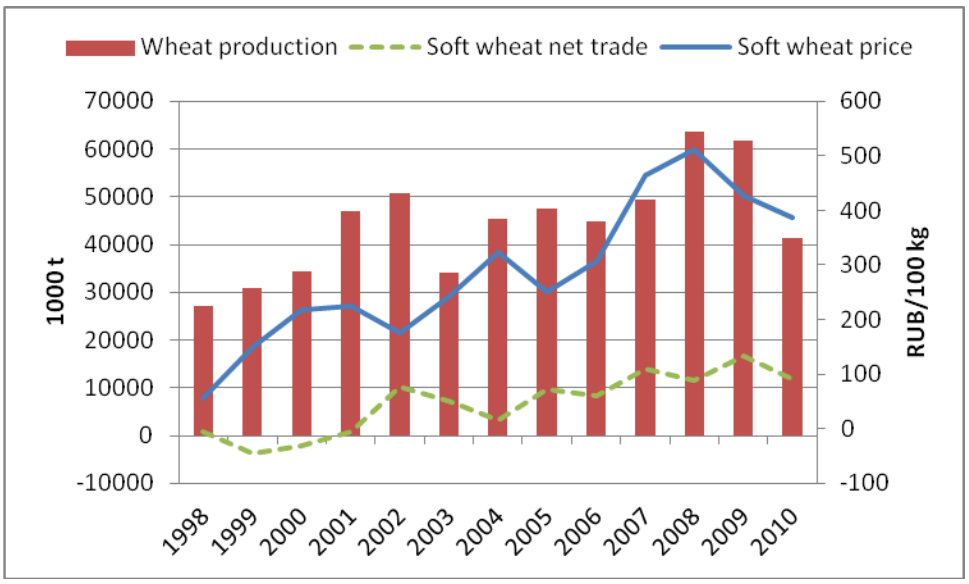


Source: FSSS

Grains production in Russia recovered considerably during the last decade and Russia became a large net exporter for grains from the mid 2000s onwards. A major driver of the increase in production and exports was the rise of large and dynamic, vertically-integrated farming operations (big farm co-operatives), which are engaged in better agricultural and management practices (cf. section 2.3).

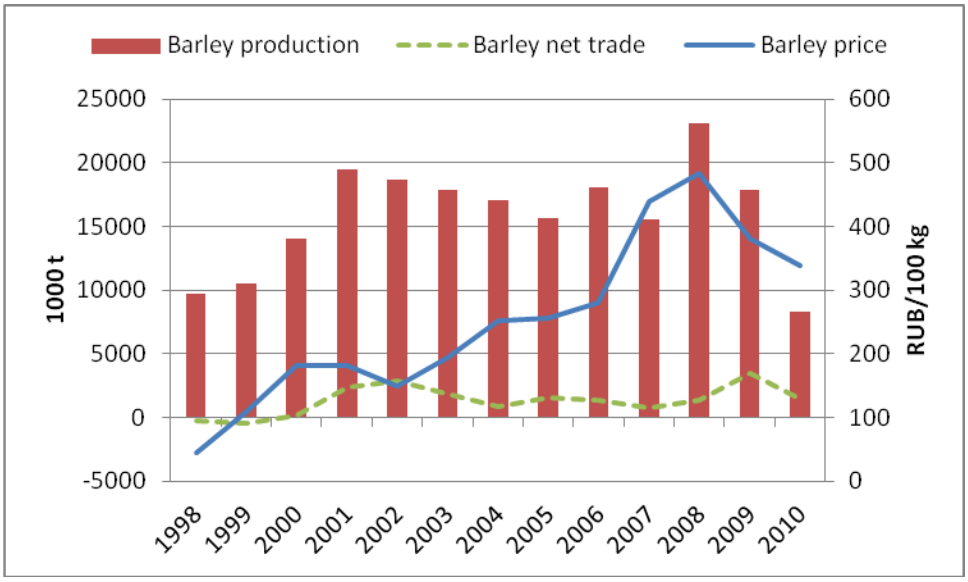
Production shares are increasing for wheat and sunflower seed. In addition to Ukraine and the EU-27, Russia is one of the biggest producers of sunflower seed. Next to the EU-27, Russia is the second biggest producer of oats in the world, and follows as the third biggest rye producer in the world after EU-27 and Belarus (USDA, 2011). Price development, production and net trade level for major crops in Russia are presented in the following Figures. Note that the sharp decline in crop production in the year 2010 was due to the record drought and severe forest fires. As reaction to the decrease in production, Russia imposed an export ban on cereals (in order to keep domestic food prices low) which had adverse effects on the domestic cereal prices.

Figure 6: Production, net trade and prices for soft wheat in Russia



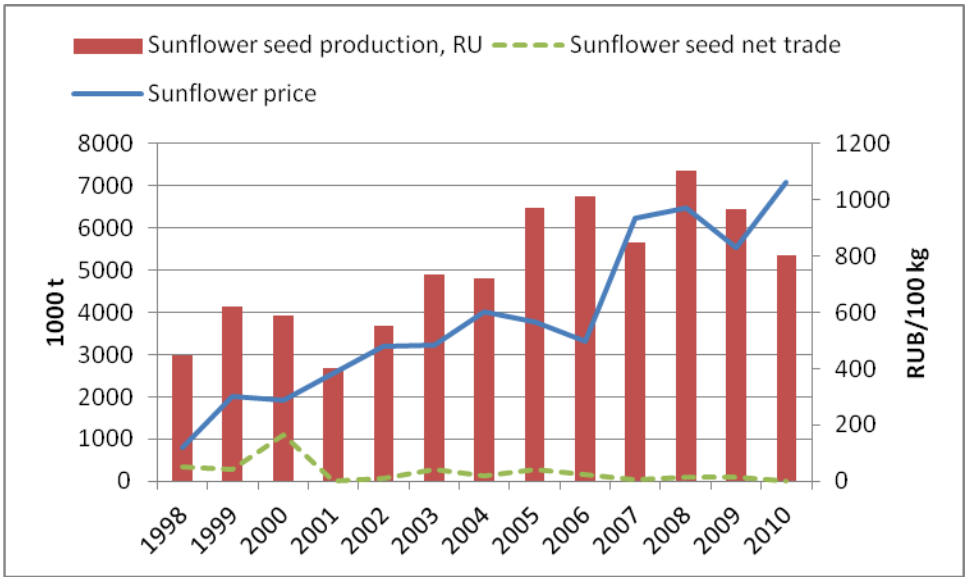
Source: FSSS

Figure 7: Production, net trade and prices for barley in Russia



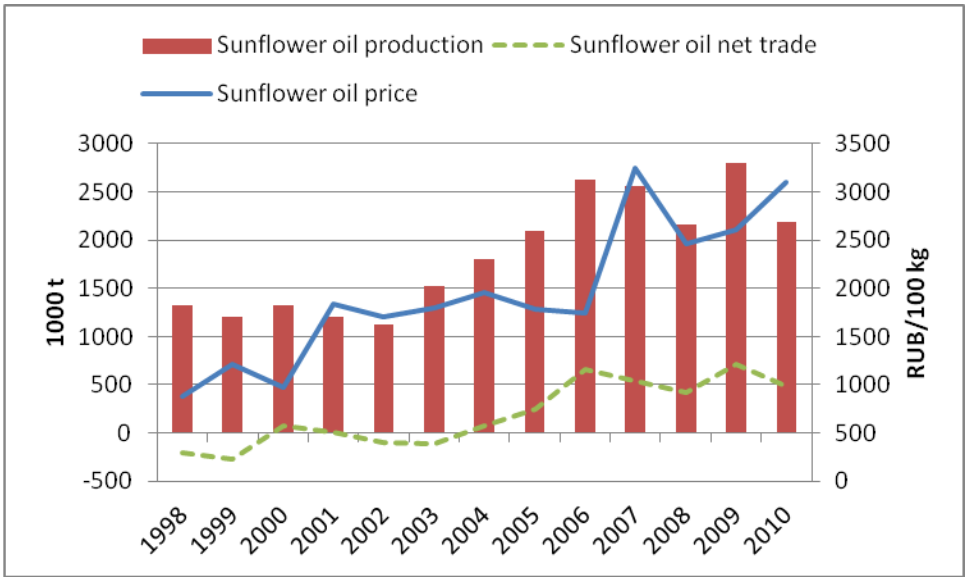
Source: FSSS

Figure 8: Production, net trade and prices for sunflower seed in Russia



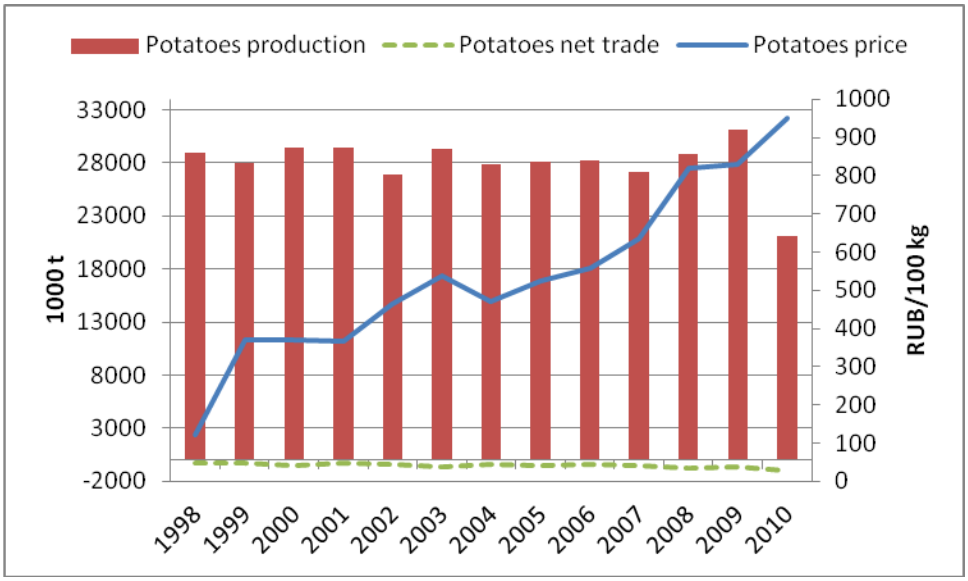
Source: FSSS

Figure 9: Production, net trade and prices for sunflower oil in Russia



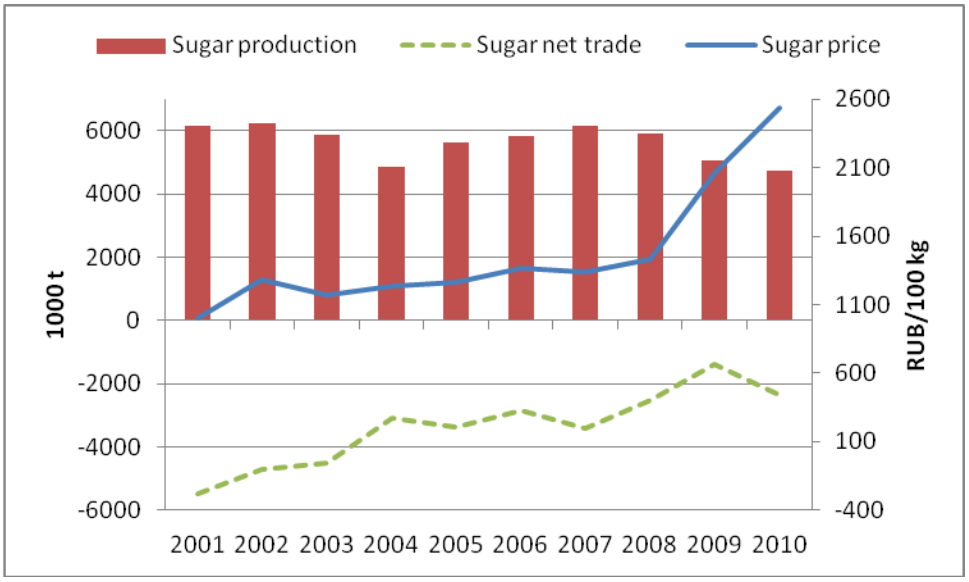
Source: FSSS

Figure 10: Production, net trade and prices for potatoes in Russia



Source: FSSS

Figure 11: Production, net trade and prices for sugar in Russia

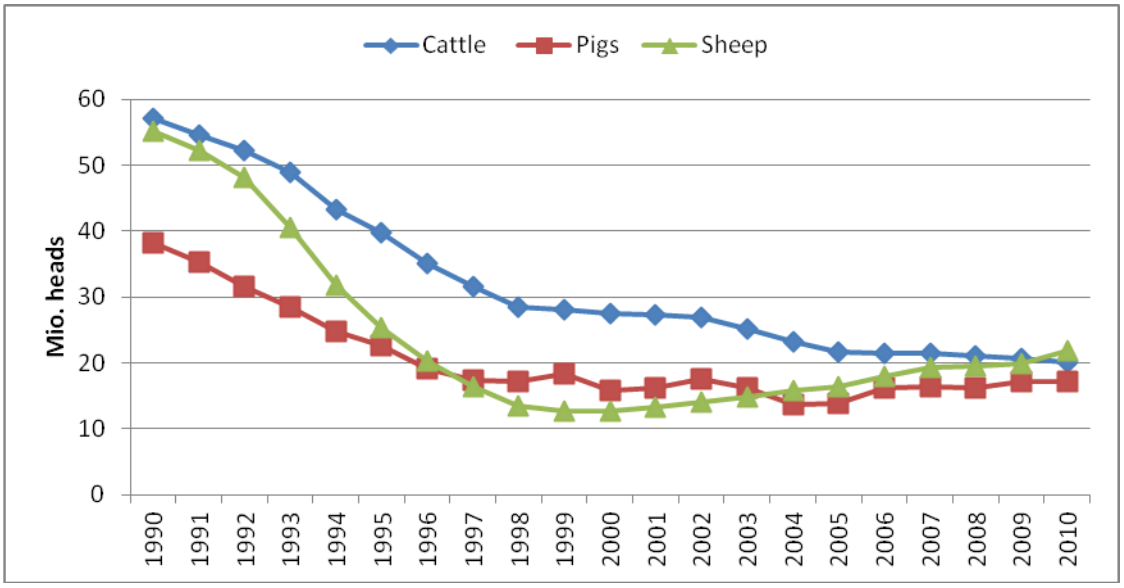


Source: FSSS

2.4.3. Livestock sector

Livestock herds decreased drastically during the 1990s, with the number of cattle and pigs dropping by about 52% and 55% respectively between 1990 and 2000. As a result, Russia became a large meat importer during the 1990s (cf. Liefert et al., 2009). When the Russian agricultural output began to rebound during the 2000s, also the livestock sector was expanding. However, while especially poultry production increased considerably, beef production continued to decline.

Figure 12: Number of cattle, pigs and sheep in Russia (mio. heads)

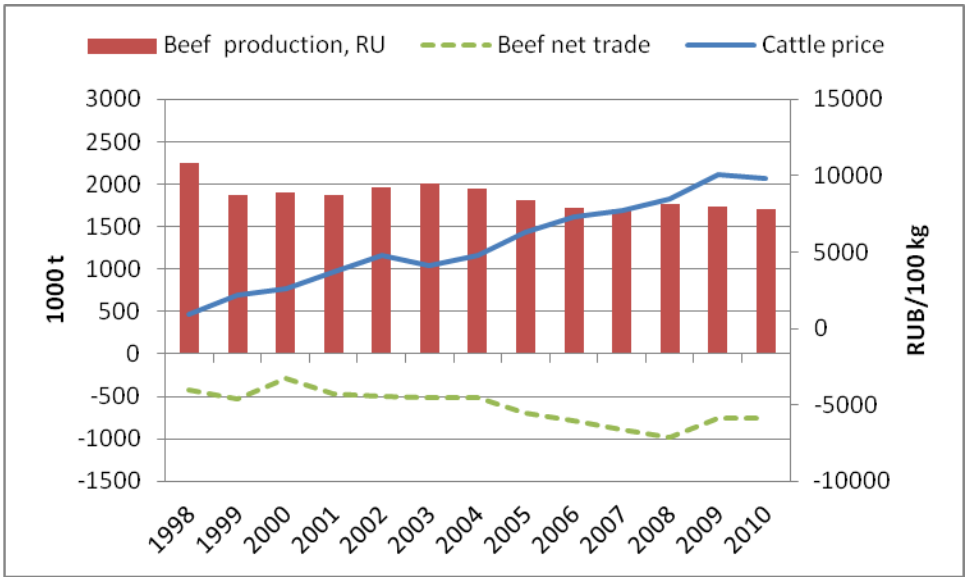


Source: FSSS

Since the beginning of the 2000s, one of the major agricultural policy objectives in Russia is to stimulate production in the livestock sector. The Russian government therefore supports the livestock sector with subsidies and market interventions. Throughout the 2000s, the Russian government established TRQs for imports of beef, pork and poultry and also imposed several sanitary-based restrictions or complete bans on imports of meat and other livestock products. Furthermore, the livestock sector benefited from the grain export restrictions imposed as responses to the surge in world food prices in 2006-08 and the grain harvest failures in 2010 caused by severe droughts.

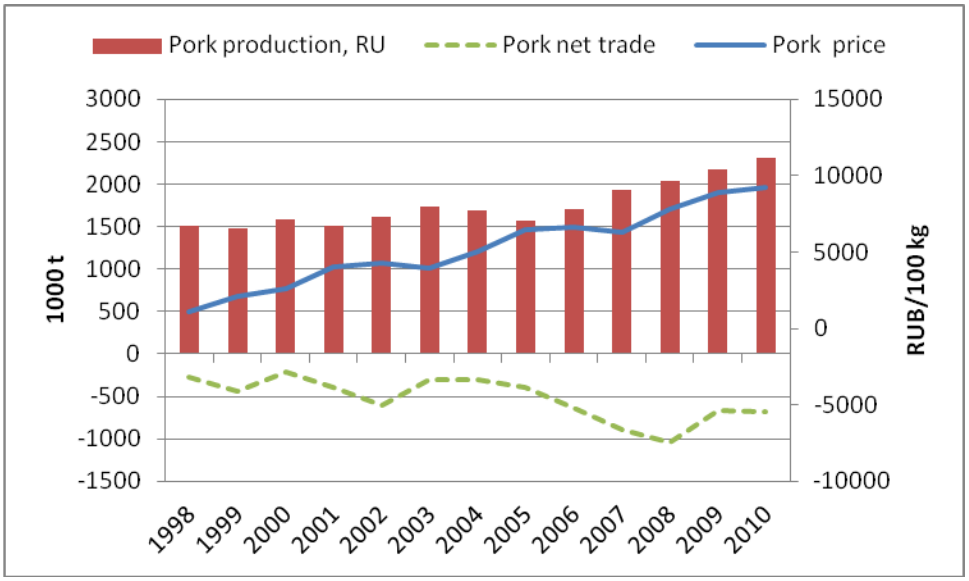
Production of meat increased significantly since 2005. The fastest growing livestock sector in Russia is poultry (where production almost doubled since 2005), which is attributable to both government support programmes and growing investments from businesses. High subsidies for pigs also helped to increase pork production, which increased by about 50% since 2005. At the same time policy measures applied in the milk and beef sectors seem to have limited effects, and the production still tends to decrease slightly. Production developments, net trade level and prices in Russia's livestock sector are presented in the following figures.

Figure 13: Production, net trade and prices for beef in Russia



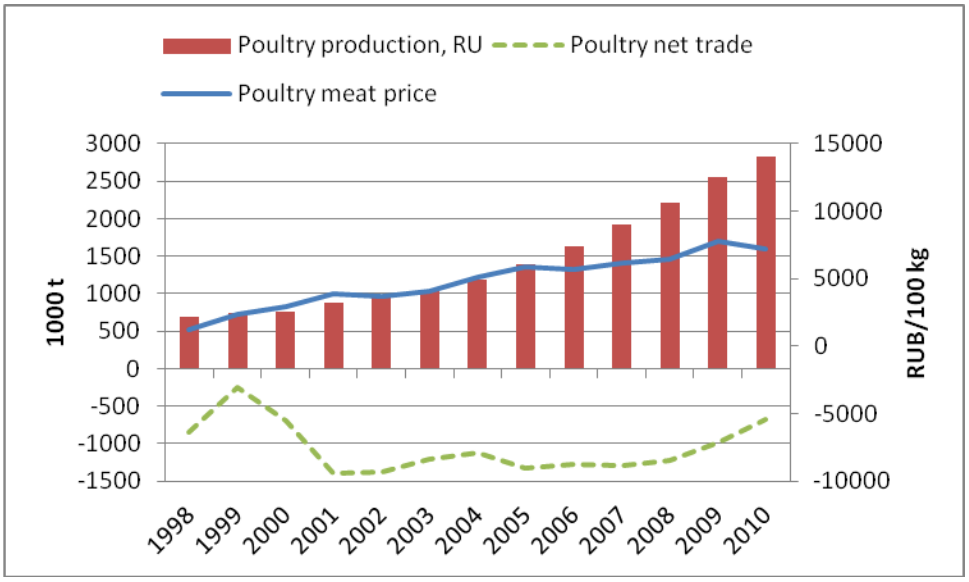
Source: FSSS

Figure 14: Production, net trade and prices for pork in Russia



Source: FSSS

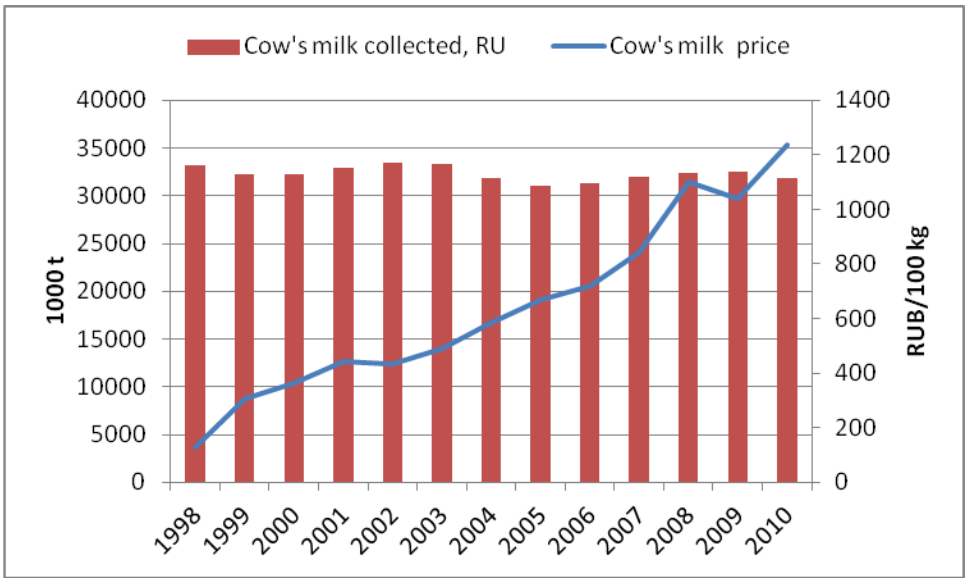
Figure 15: Production, net trade and prices for poultry in Russia



Source: FSSS

Regarding milk production, Russia is still among the largest producers of milk in the world, but it lacks behind many developed countries with respect to per capita production and average consumption of dairy products. Average milk production in Russia is small-scale, and more than half of the milk is produced on household farms with only one or two cows (cf. Serova and Karlova, 2010, Fellmann and Nekhay, 2012).

Figure 16: Production and prices for cow's milk in Russia



Source: FSSS

2.5. Productivity and competitiveness

The observation of some productivity indicators shows that returns on agricultural land (i.e. value added in USD/ha) in Russia accounted for 245 USD/ha, returns on labour (i.e. value added in USD/person) was about 7670 USD/person, while the return on capital assets was negative with a value added of 0.50 per every USD invested (see Table 4).

Table 4: Productivity indicators for Russia, 2010

Return on agricultural land (value added in USD/ha)	245
Return on capital assets (value added in USD/USD)	0.50
Return on labour (value added in USD/person)	7670

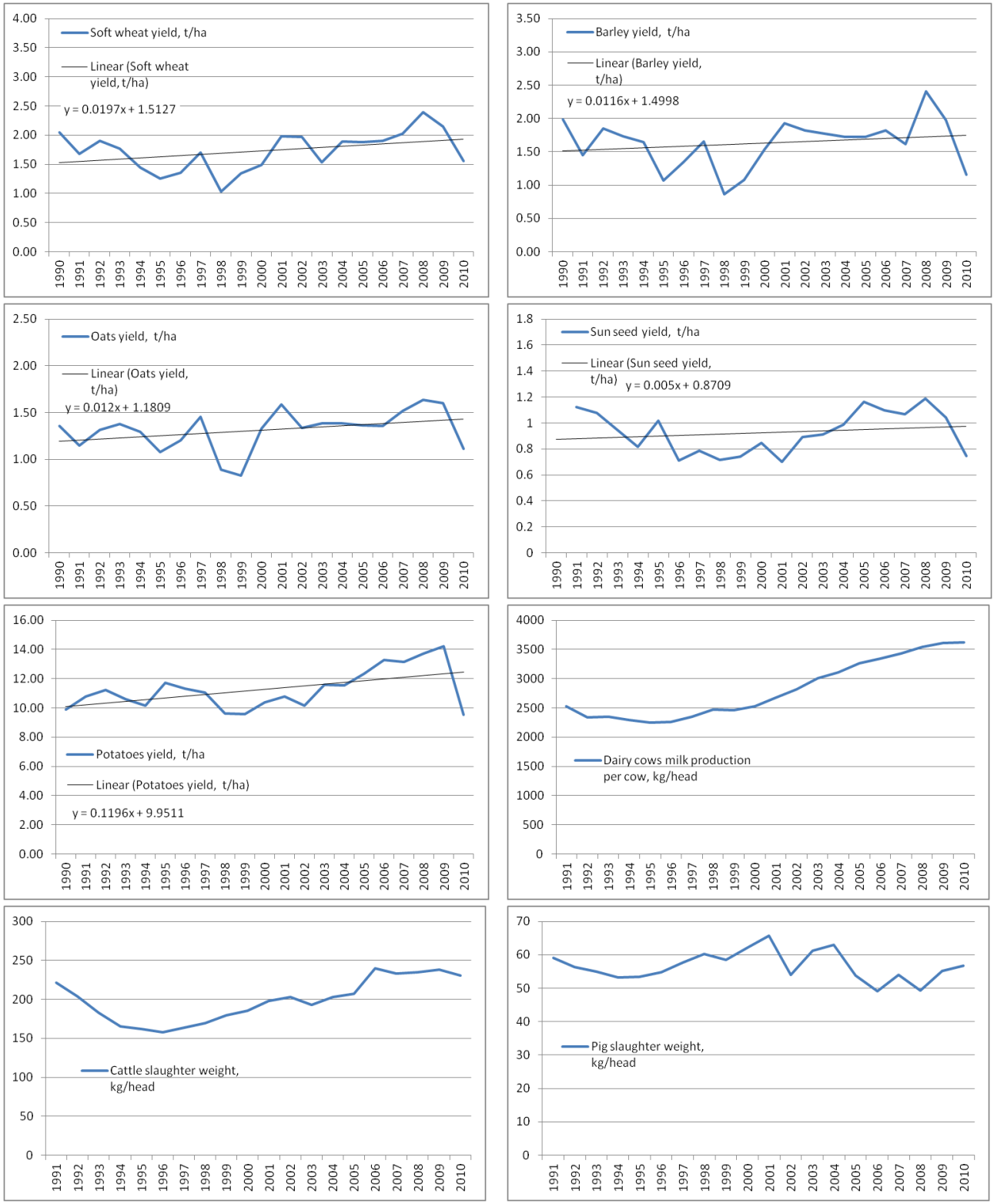
Source: own calculations based on data from FSSS

Compared to EU-15 and EU-12, production factors' return in Russia is significantly lower on land. Regarding labour productivity it is at about the same level as in the EU-12, but six times lower than in EU-15. There is a wide range of studies that analyse the (development of) productivity and efficiency in Russia's agricultural sector (see for example Voigt and Uvarovsky, 2001, Liefert, 2002, Bokusheva and Hoeckmann, 2006, Latruffe, 2010, Bokusheva et al., 2012). However, the scope of this subchapter is not to give a detailed analysis of the productivity and the competiveness of Russia's agricultural sector, but only a brief overview on the development of yields (section 2.5.1) and a brief evaluation of the general level of competitiveness of the agri-food sector in Russia (section 2.5.2).

2.5.1. Yields

Average yields per hectare in Russia are more than two times lower than average yields of cereals in the EU-27, and productivity growth is very slow. Sharp fluctuations and huge differences between the lowest and the highest yield levels could suggest a need for better risk management and show the potential of yield improvement (Figure 17). The low yields in crop production are closely related to low use of fertilizers. Even though input of fertilizers per hectare has doubled during the last decade from 19 kg/ha to 38 kg/ha in 2010, it is still far below the average use of fertilizer in the EU-27. The share of areas where fertilizers have been used also increased from 27% in 2000 up to 42% in 2010.

Figure 17: Yields and yield trends for selected commodities in Russia



Source: Own calculations based on data from the FSSS

2.5.2. Level of competitiveness

For this report the level of competitiveness of the agri-food sector in Russia was evaluated and compared with the same indicators for the EU-27 by using the ’revealed comparative advantage‘ and derived indicators as trade measures of competitiveness.[7]

The revealed comparative advantage was first formulated by Balassa (1965) and modified by Vollrath (1991). Vollrath’s modified version is called the relative export advantage (RXA) measure, as it is based on exports. The RXA calculates the ratio of a country’s export share of a commodity in the international market to the country’s export share of all other commodities. For the i-th country and j-th commodity, the RXA is defined as follows:

$$RXA_{ij}=(X_{ij}/X_{ik})/(X_{nj}/X_{nk}), \quad (1)$$

where X are exports; k denotes all commodities other than j; n denotes all countries other than i. An RXA index greater than 1 indicates that the country has a comparative advantage in the commodity under consideration, since it has a strong export sector. Hence a RXA index greater than one reveals higher competitiveness (Latruffe, 2010).

Another measure for comparative advantage is the relative import advantage (RMA) index, which is similar to the RXA, but relates to imports (M) rather than exports:

$$RMA_{ij}=(M_{ij}/M_{ik})/(M_{nj}/M_{nk}) \quad (2)$$

An RMA index less than 1 indicates revealed comparative advantage and thus higher competitiveness. A more comprehensive indicator of revealed comparative advantage is given by the relative trade advantage (RTA), which is given by the difference between the indices RXA and RMA, i.e.:

$$RTA_{ij}= RXA_{ij}-RMA_{ij} \quad (3)$$

A positive value of RTA is an indication of comparative advantage.

The calculated indices of comparative advantages of agricultural and food products in Russia and the EU-27 for the period 2007-2010 are presented in (Table 5). The calculated RTA value for

[7] The following explanation on the trade measures of competitiveness ‘revealed comparative advantage’ and the derived indicators is taken from Latruffe (2010) and is the same as in Leeuwen et al. (2012).

Russia is positive for primary agricultural goods, but negative for processed food. This indicates towards the existence of comparative advantages in the Russian production of agricultural commodities, which are also relatively competitive within the context of the whole Russian economy. On the other hand, all calculated indicators indicate a low competitiveness for Russia's food products. The EU-27 as aggregated region does not show a comparative advantage for primary agricultural commodities, suggesting that the EU-27 is less competitive than Russia regarding exports of agricultural products. In contrast, the EU-27 indicators show more competitiveness than Russia regarding food products.

Table 5: Indices of comparative advantages of agricultural and food products in Russia and EU-27

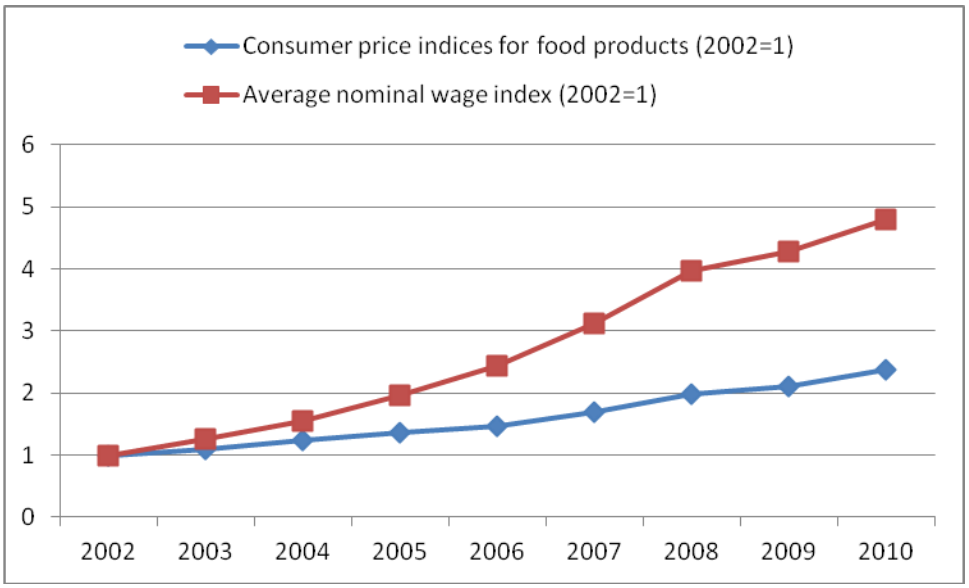
		2007	2008	2009	2010
Russia	$RXA_{food,RU}$	0.52	0.38	0.52	0.38
	$RXA_{agri,RU}$	2.04	1.66	1.76	1.46
	$RMA_{food,RU}$	1.78	1.63	1.88	1.93
	$RMA_{agri,RU}$	0.48	0.49	0.64	0.58
	$RTA_{food,RU}$	-1.26	-1.25	-1.36	-1.56
	$RTA_{agri,RU}$	1.57	1.16	1.11	0.88
EU-27	$RXA_{food,EU}$	1.19	1.20	1.19	1.21
	$RXA_{agri,EU}$	0.97	1.00	1.02	1.00
	$RMA_{food,EU}$	1.20	1.19	1.23	1.17
	$RMA_{agri,EU}$	1.05	1.05	1.06	1.06
	$RTA_{food,EU}$	-0.02	0.01	-0.04	0.04
	$RTA_{agri,EU}$	-0.08	-0.05	-0.03	-0.06

Note: RXA = relative export advantage, RMA = relative import advantage, RTA = relative trade advantage
Source: own calculations based on WTO data

2.6. Development of consumer prices and food consumption

Food demand in Russia increases at a faster rate than average real incomes. At the same time developments of average nominal wages and food price indices show that the increase of wages has been more than twice as fast as food price increases in Russia during the 2000s (Figure 18). However, Russia's poverty rate still amounted to almost 13% in 2011 and although Russia's middle-class has grown substantially, its number is still matched by those living in poverty. Moreover, there is a huge income gap between the top 10% and the bottom 10% of earners, which is estimated to be about 16 times.

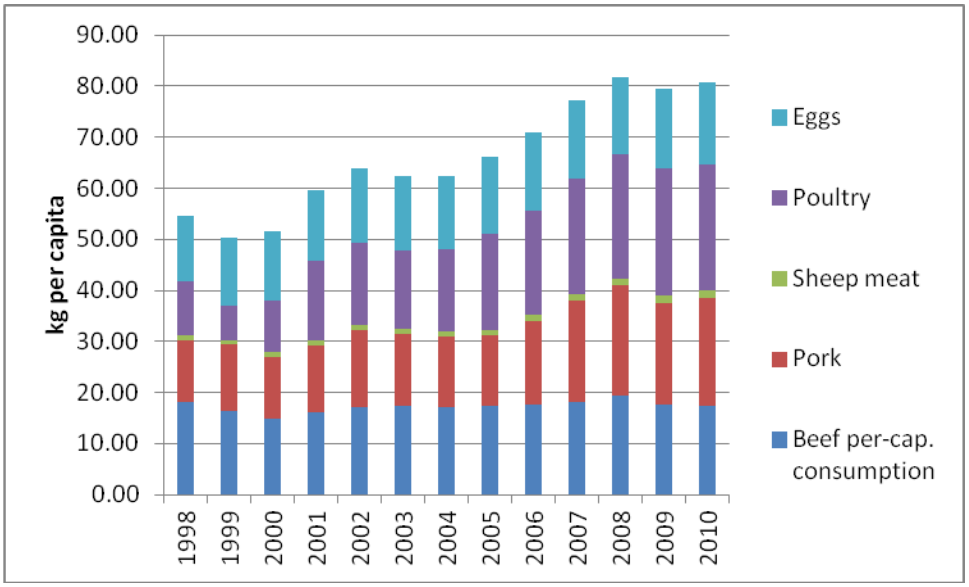
Figure 18: Consumer price index for food products and average nominal wage index for Russia



Source: own calculations based on FSSS data

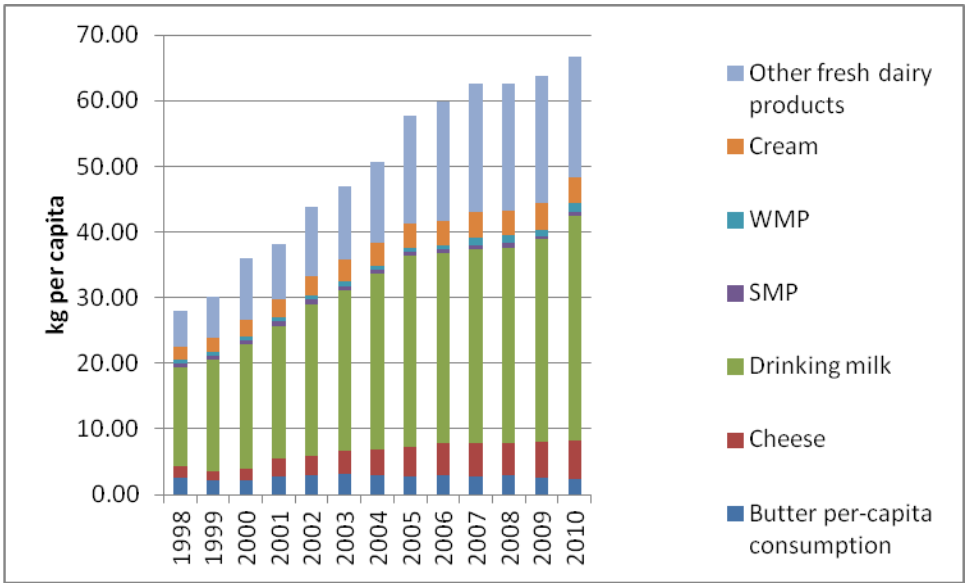
Domestic consumption per capita for animal products increased quite strongly since 1998 with the exception of some few products like e.g., butter, eggs or sheep meat. The highest increase has been observed for poultry and pork (Figure 19), as well as for drinking milk and other fresh dairy products (Figure 20).

Figure 19: Consumption of meat and eggs products in Russia (kg per capita)



Source: own calculations based on FSSS data

Figure 20: Consumption of dairy products in Russia (kg per capita)



Source: own calculations based on FSSS data

3. Baseline settings for the market outlook

The AGMEMOD (Agricultural MEmber states MODelling) model was used to generate the market outlook for the agricultural commodity market developments in Russia until 2025. Some general information on the modeling approach is given in section 3.1[8], followed by information on the general baseline assumptions in section 3.2. The specific macroeconomic assumption on the development of Russia's GDP growth and exchange rates are presented in section 3.3 and the specific baseline assumptions on agricultural and trade policies in Russia are outlined in section 3.4.

3.1. The AGMEMOD modelling approach

AGMEMOD is an econometric, dynamic, partial equilibrium, multi-country, multi-market model designed to analyse European agriculture and the CAP. The model covers all EU Member States (except Malta) and also incorporates the EU candidate countries Croatia, the Former Yugoslav Republic of Macedonia and Turkey. Given the importance of Russia's and Ukraine's agricultural sector, especially with regard to grain exports, the AGMEMOD model was recently expanded towards both countries in order to capture the developments in Russian and Ukraine agricultural policy and markets and their respective impacts on agricultural world markets.

Based on a set of commodity specific model templates, respective country models for each country represented in AGMEMOD are developed. The template approach allows reflecting the details of agriculture at country level and at the same time assures analytical consistency and the inclusion of all country models into a combined model. The individual country models consist of behavioural, parametric relations which are estimated from historical time series data. The equations of a country model are estimated by the AGMEMOD partner responsible for the respective country, and the model parameterisation process is broken into stages for pre-

[8] The explanation on the AGMEMOD modelling approach is basically the same as presented in the report for Ukraine (cf. Leeuwen et al., 2012). More detailed information on the AGMEMOD model is presented in the Annex.

estimation, estimation, post-estimation, calibration and validation (Chantreuil et al, 2011, cf. Annex).

Former versions of AGMEMOD used exogenous data for the development of agricultural world market prices. However, the latest AGMEMOD version now also includes endogenous world market price formation and, thus does not require exogenous world market price assumptions for the agricultural commodities modelled. For the endogenous formation of world market prices AGMEMOD was extended with a new region covering the rest of the world (ROW). This ROW region is not represented according the usual econometrically estimated approach in AGMEMOD but in a simplified way. One simplification is that the ROW does not capture any policy measures affecting consumption, production and trade. However, ROW's production and consumption is directly driven by the endogenous world prices. Another simplification is that the parameters of the behavioural supply and demand equations are not estimated econometrically, but are derived from other existing models implying that assumptions on these parameters are required. To calibrate the endogenous price formation exogenous world market prices are used (cf. Annex).

3.2. General baseline assumptions

The baseline provides projections for the development of agricultural commodity markets in Russia until the year 2025, based on a set of coherent macroeconomic and policy assumptions and under the assumption of normal weather conditions and steady demand and yield trends. For the baseline projections a status quo policy environment is assumed, i.e. currently applied agricultural domestic and trade policy instruments in Russia continue unchanged up to the projection year 2025. Consequently it is assumed that Russia will not conclude any new trade agreement, international trade is governed by the Uruguay Round Agreement on Agriculture (URAA), and Russia will not apply export or import bans during the projection period. However, it is assumed that Russia continues to protect its domestic agricultural sector via import tariffs, tariff rate quotas, export quotas and export taxes (see section 3.4 for more details on the specific assumptions on Russia's agricultural and trade policies).

3.3. Specific macroeconomic assumptions for Russia

Macroeconomic data are needed to generate the projections for the main agricultural commodities in Russia. Historical data on macroeconomic variables like population, inflation, per capita economic growth and currency exchange rates have been assembled. In order to conduct the baseline simulations for the period 2011 to 2025, exogenous projections for the development of the macroeconomic variables are needed also needed for this time period. In general, these macroeconomic projections are obtained from the national statistical offices in the respective countries involved in AGMEMOD as well as in Russia.

Table 6 captures the macroeconomic data for Russia over the period from 2000-2025. For the historical period up to 2010, data on Russian populations, GDP and the average exchange rates have been collected by the FSSS and Central Bank of Russia (CBR). Projections over 2010-2025 are based on the same sources and FAPRI assumptions (cf. FAPRI, 2011).

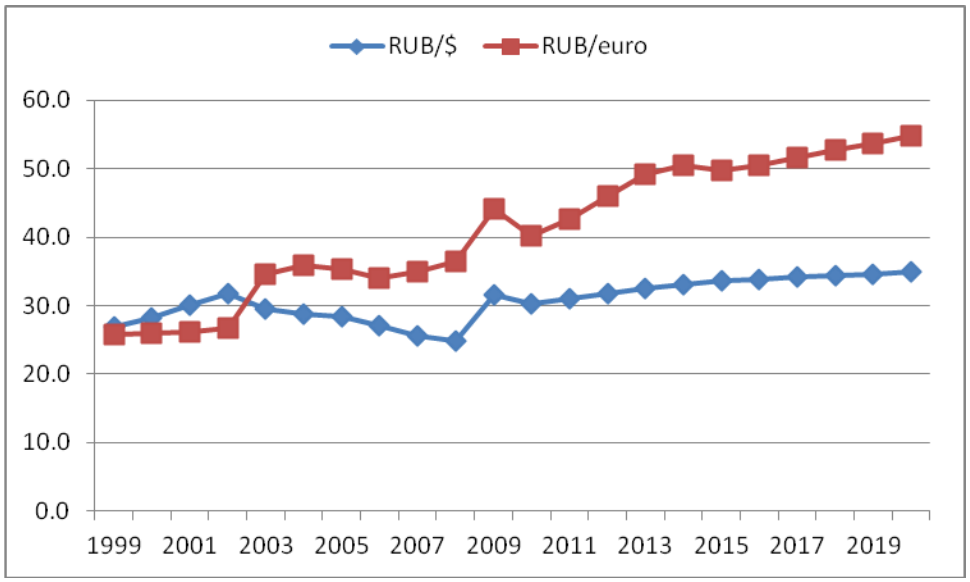
Table 6: Assumptions on macroeconomic variables for Russia

	Unit	2000	2005	2008	2009	2010	2015	2020-2025
Population	Millions	147	144	142	142	142	138	134
Real GDP	Billion RUB (2000)	7306	9837	12151	11198	11641	13913	16207
GDP deflator	2000=1.00	1.00	2.20	3.40	3.46	3.82	4.90	5.79
Real GDP/cap	2000 prices	49732	68553	85572	78916	82091	100620	120622
Exchange rate	RUB/Euro	26.01	35.26	36.41	44.13	40.27	49.76	54.75

Source: CBR, FSSS

The exchange rate between the Euro and the US dollar is a key macroeconomic factor, since it influences the Euro value of the exogenous world prices used in the AGMEMOD model. The USD/Euro exchange rate projection is taken from the FAPRI annual world market outlook (FAPRI, 2011). The assumptions on the evolution of the USD/Euro exchange rate are based on the observed exchange rate for 2010 and the percentage change in this exchange rate that have been published by FAPRI in spring 2011. For non-Eurozone countries, including Russia, the exchange rate between these national currencies and the US dollar is derived from their exchange rate with the Euro and the baseline USD/Euro exchange rate, so that projected exchanges rates are consistent with the absence of possibilities for triangular arbitrage. Figure 21 presents the historical and projected RUB/Euro exchange rate for the period 1990-2020.

Figure 21: Historical and assumed future developments of RUB/USD and RUB/Euro exchange rates



Source: CBR, FAPRI

3.4. Specific assumptions on agricultural and trade policies of Russia

The agricultural domestic policy of Russia reflects a package of instruments such as direct income supports and price supports. For the baseline projections in this report it is assumed that this current package of policy instruments continues unchanged up to the projection year 2025.

With respect to agricultural trade policy developments, the baseline makes no assumptions concerning the outcome of the still ongoing Doha Development Round of the WTO. As no probable quantitative outcome is available so far, the impact of the Doha Round would be speculative. Russia is a member of the WTO since 22 August 2012. However, the simulations for the outlook have been conducted in the beginning of 2012 and therefore Russia's accession to the WTO and the associated commitments are not taken into account. Thus for the baseline projections the Russian border policy applied to protect Russian agriculture - which reflects a package of import tariffs, export quota and export taxes - is assumed to be applied unchanged up to 2025. This assumption is not necessarily contradictory to the entry of Russia into the WTO as the commitments for Russia are set on average level of market support for commodity groups (dairy products, cereals, oilseeds) mostly without specification on particular products. For meat

the quota tariff rates under baseline assumptions will differ only for pork significantly from those agreed in Russia's WTO negotiations.

Details on agricultural policy measures in Russia are presented in the following tables, which show direct support (Table 7), market support prices (Table 8) and trade measures (Table 9). For the projections, the last observed amounts of support will remain valid up to 2025.

Table 7: Observed (2000-2010) and projected (2011-2025) total agricultural direct support in the Russian AGMEMOD model

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011-2025
Direct support	3690	5473	4917	4781	4083	4900	5405	8608	11836	17150	17010	9513
- wheat	0	0	0	0	0	55	0	0	24	187	200	0
- barley	0	12	5	7	0	20	0	0	3	71	70	0
- maize	0	0	0	0	0	4	0	0	0	0	0	0
- rye	0	4	1	1	0	4	0	0	8	9	10	0
- oats	0	4	1	1	0	5	0	0	9	57	60	0
- sunflower	0	0	0	0	0	16	0	0	0	0	0	0
- soybean	36	0	0	0	0	0	0	0	0	0	0	0
- potatoes	5	12	10	10	0	77	0	0	10	22	20	0
- sugar	0	0	0	0	0	11	0	0	0	0	0	0
- milk	1840	3216	3439	3264	2522	3342	4163	5922	8987	12329	12166	7200
- beef	442	358	197	210	247	211	206	379	378	2446	2446	260
- pork	568	595	327	348	411	339	342	629	627	442	440	440
- poultry	293	677	372	396	467	424	388	715	713	502	500	500
- sheep	0	0	0	0	0	0	0	610	610	624	638	653
- eggs	506	595	564	544	437	392	306	354	467	462	460	460

Table 8: Market support prices for agricultural commodities in the Russian AGMEMOD model

	Unit	2000	2002	2003	2005	2009	2010-2025
Market support prices							
Soft wheat	RUB/100kg	0	230	440	310	550	420
Rye	RUB/100kg	0	0	0	250	390	290
Barley	RUB/100kg	0	0	0	0	380	380
Maize	RUB/100kg	0	0	0	0	400	400

Table 9: Agricultural trade policy measures in the Russian AGMEMOD model

	Unit	2000	2001	2002	2003-2005	2006	2007	2008	2009	2010-2025
Import tariffs										
Soft and durum wheat	%	5	5	5	5	5	5	5	5	5
Barley, rye, maize, oats	%	5	5	5	5	5	5	5	5	5
Rapeseeds	%	5	5	5	5	5	5	5	5	5
Sunflower oil, rape oil, soy oil	%	15	15	15	15	15	15	15	15	15
Rape meal	%	0	0	0	0	5	5	5	0	0
Cattle	%	0	0	0	5	5	5	5	5	5
Beef	%	0	0	0	15	15	15	15	15	15
Pigs	%	0	0	0	0	0	0	0	40	40
Pork	%	0	0	0	15	15	15	15	15	15
Sheep	%	0	0	0	5	5	5	5	5	5
Sheep meat	%	0	0	0	25	25	25	25	25	25
Poultry	%	0	0	0	25	25	25	25	25	25
Export tax										
Soft and durum wheat[1)]	%	0	0	0	0	0	10	10	10	0
Barley	%	0	0	0	0	0	30	30	30	0
Rapeseeds	%	10	10	10	10	10	10	15	15	15
Sunflower	%	10	10	20	20	20	20	20	20	20
Soybeans	%	0	0	0	0	0	0	20	20	20

1) The ban for grain exports from Russia came into force on August 15, 2010.

4. Russia market outlook for main agricultural commodities

The market outlook presented in this chapter is a model based projection of the future development of main agricultural commodity markets in Russia until the year 2025 with endogenous formation of world market prices.[9] The projections are based on a set of coherent macroeconomic and policy assumptions and the details of the narrative and the assumptions underlying the baseline projections are outlined in the previous chapter 3. All presented graphs show historical data up to the year 2010 and projections until 2025. Consequently the figures do not reflect the actual figures for the years 2011 and 2012. Furthermore, it has to be highlighted that the AGMEMOD projections assume normal weather conditions and steady demand and yield trends (following recent time paths), thus disruptions caused for example by bad weather conditions are not considered. Therefore the projections show rather smooth developments, whereas in reality it is very likely that the markets move along more volatile paths.

4.1. Grains and oilseeds

Prices

Similar to what has been observed in the past, Russian cereal prices are projected to follow also over the projection period their respective world market prices. However, as interventions into the grain market are assumed to stay valid, prices in Russia for all cereals and oilseeds are projected to remain below the world price level and also below the EU-27 level. Wheat prices

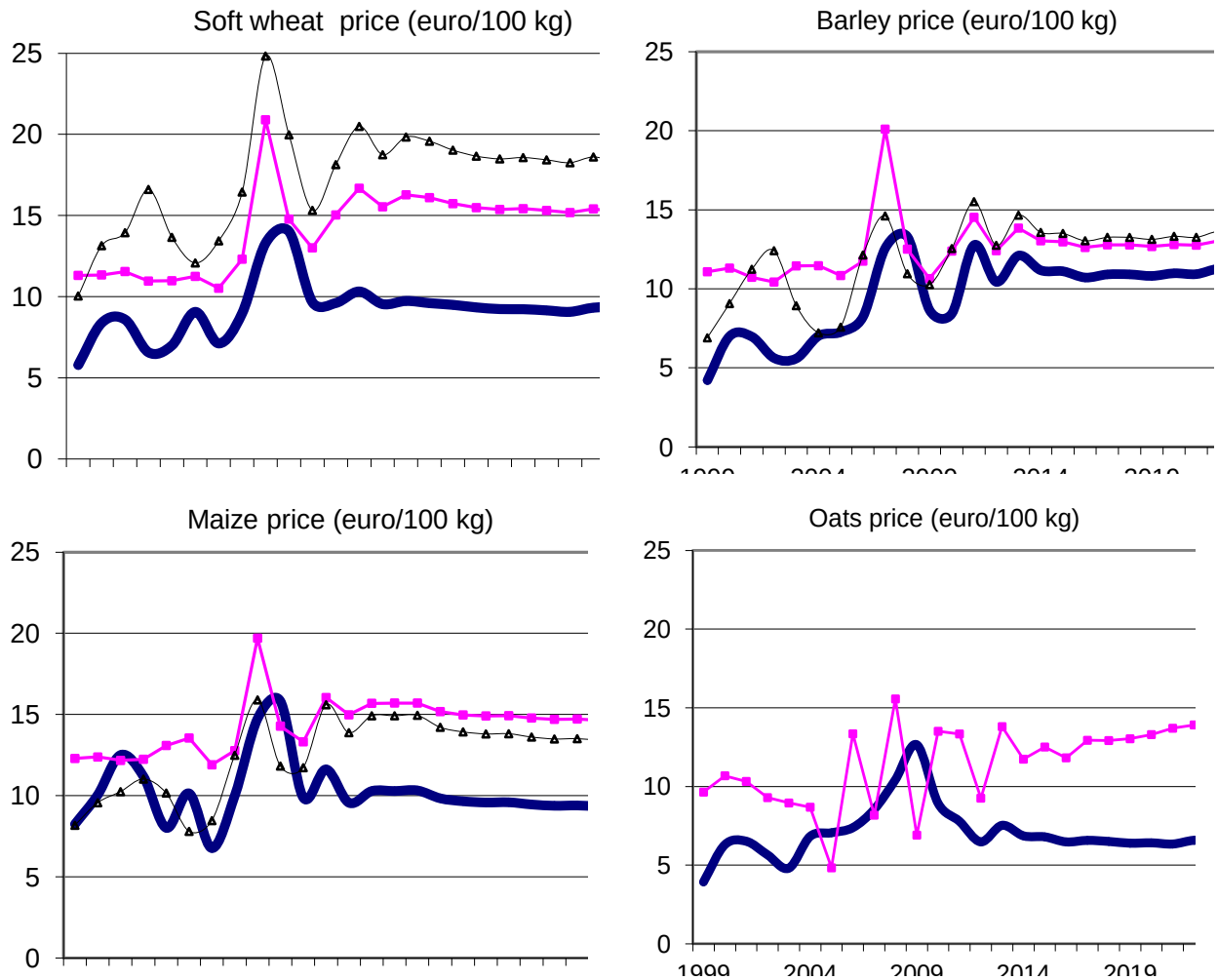
[9] Concerning the endogenous price formation it has to be mentioned that policies in the ROW are not modelled in AGMEMOD and the price wedge between cif and fob is not covered yet. Furthermore, the new ROW's production and consumption in AGMEMOD is determined directly by world prices without any wedges between world and producer or consumer prices. Another simplification is that the parameters of the behavioural supply and demand equations have not been estimated econometrically, but are mainly derived from other existing partial equilibrium models like e.g. ESIM and FAPRI.

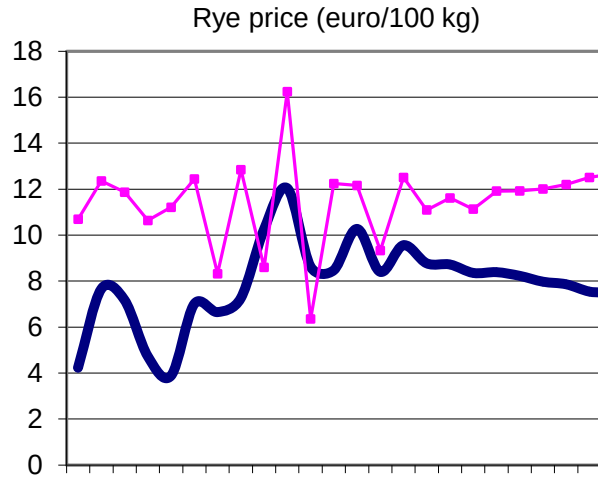
The country sector modelling for Russia also does not take into account any price differences for agricultural products within Russia. This assumption is in line with the findings in Gluschenko (2011), which suggest that about 80% of Russia's regions are tended on spatial integration of their markets.

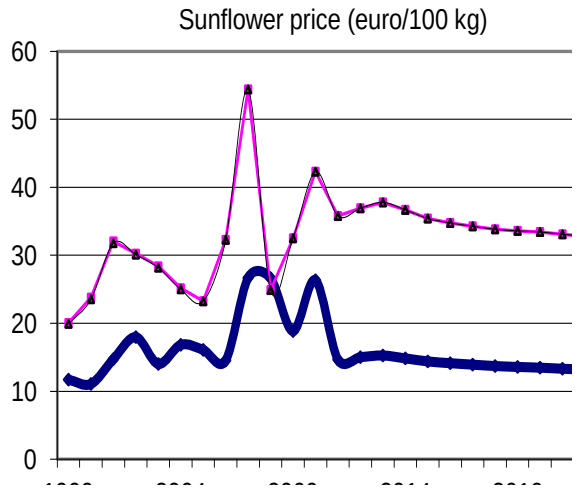
Another issue in the AGMEMOD model relates to the assumption of commodity homogeneity. In reality many of the price spreads observed are due to quality differences between commodities. However, in AGMEMOD there is only one price per commodity used as the key price, although the product in question can be very heterogeneous across countries. This problem holds for the EU-27 and Russia alike.

are projected to remain quite stable, but will surpass the very low price period from 1998 to 2006. Prices of the other important cereals such as maize and barley display comparable levels and developments. The marginal price increase of barley occurring in some years may be explained by the continuous shift out of the production of barley into products which provide easier selling opportunities to the world market. The prices of other cereals are much lower than wheat and barley. Rye is comparatively less popular for food use in Russia as well as not to be used for feed, therefore due to local market of this grain the price is expected gradually drop down back to the level of pre-peak period. Moreover, prices for oilseeds do not reach international price levels. Reasons for those big price differentials to world market prices are manifold and are especially subject to quality problems and huge transaction cost. Moreover, government interventions in Russia hinder the possibility of selling cereals on the world markets.

Figure 22: Cereal and oilseed prices in Russia, EU and the world (Euro/100 kg)



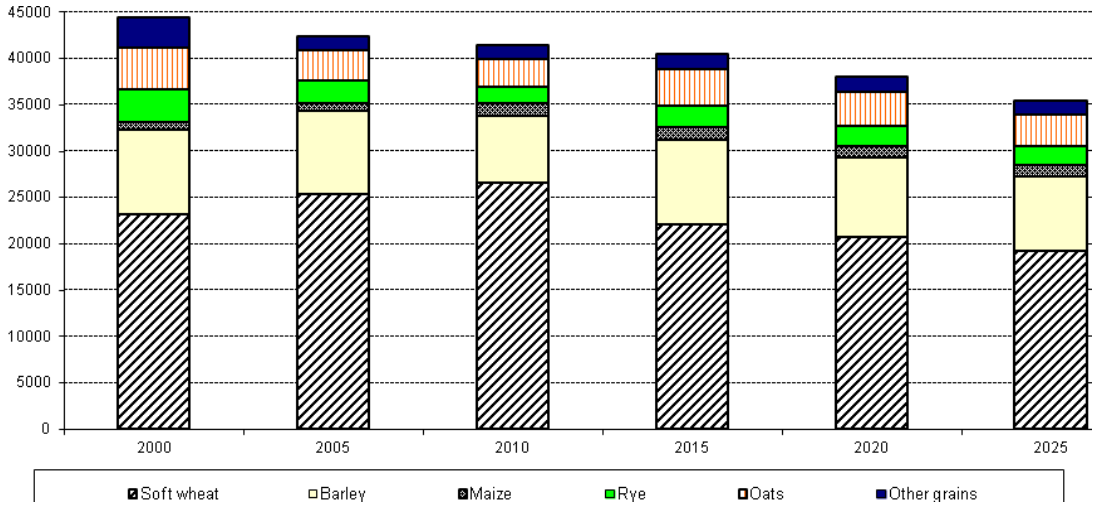




Areas and yields per hectare

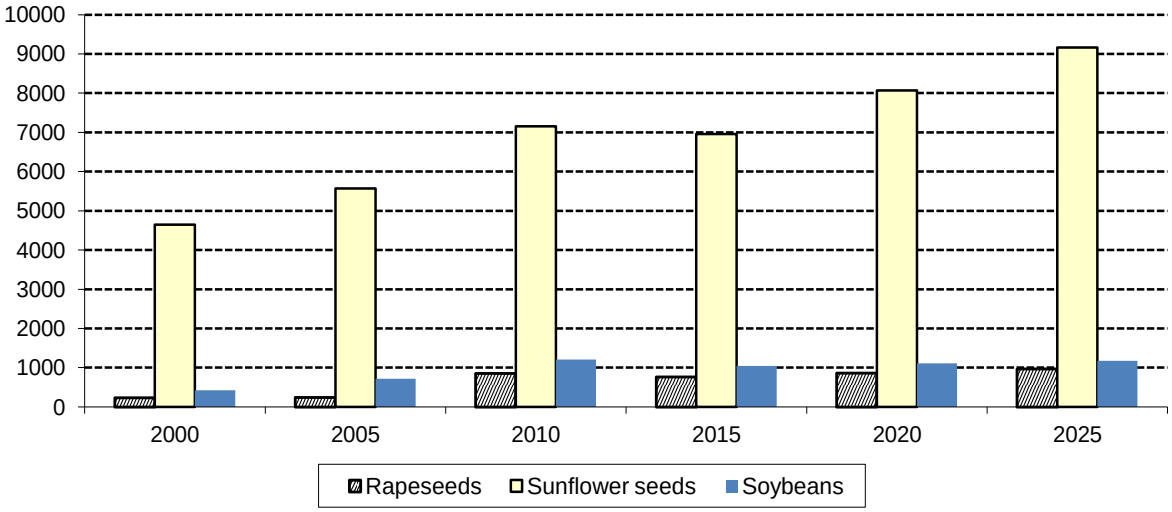
Compared to 2010, total area allocated to cereals and oilseeds is projected to decrease by 10% over the projection period until 2025. As grain areas are projected to decrease by 15%, the area share of oilseeds is increasing. This result is driven by the fact that the Russian cereal market, and in particular the wheat market, is quite separated from the world market. Under normal weather conditions Russian cereal prices remain stable at a low level and thus providing no incentive to increase areas, on the contrary, due to yield increases area will decline. At the same time most domestic livestock production (apart from poultry) is expected to remain rather inefficient and thus no additional domestic demand pull is projected to affect the Russian cereal sector. This could change if bio-energy production put more emphasis on ethanol processing than on biodiesel.

Figure 23: Cereal areas in Russia, 5-year averages (1,000 ha)



Emphasis on biodiesel in Europe drives international demand for oilseeds. Moreover, in Russia oilseeds show higher returns per hectare compared to cereals. Therefore land is projected to be reallocated towards oilseeds (particularly sunflower seeds), and the Russian oilseeds area is expected to grow by 23% in 2025 compared to 2010.

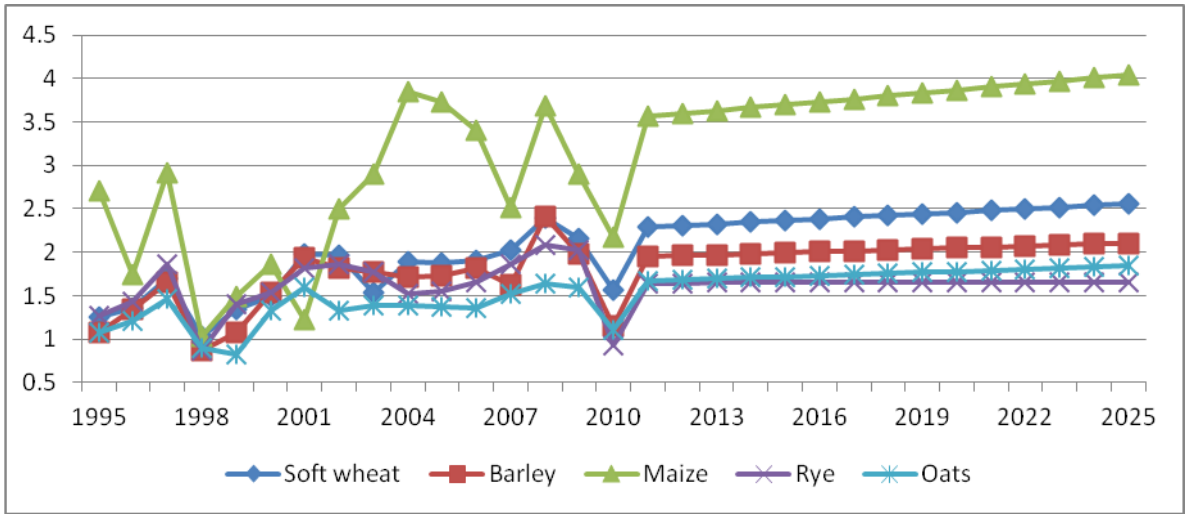
Figure 24: Oilseeds areas in Russia, 5-year averages (1,000 ha)



Average yields per hectare in Russia are more than twice lower than average yields of cereals in the EU-27, and productivity growth is very slow. Sharp fluctuations and huge differences between the lowest and the highest yield levels show the potential for yield improvements. At the same time the yield variations give an indication of the potential impacts of weather conditions

on the output. One of the reasons of low yields is the low level use of fertilizers and pesticides. Following the historical trends, further yield growth is expected due to the use of higher-yielding seed varieties and more input intensive agricultural techniques. Average historical and projected yields per hectare in Russia for main cereals over the period 1995-2025 are presented in Figure 25.

Figure 25: Cereal yields in Russia (tonnes/ha)



Production, domestic use and net exports

The following figures present the projections for production, domestic use and net-exports for Russia's main cereals (wheat, barley) and oilseeds (sunflower seed). In general, the production depicts a rather stable amount for wheat and barley production, driven in particular by yield growth that compensates the decline in area. On the other hand, the projected increase in sunflower seed production is due to a combination of increases in yield and area. Higher feed use demand for maize and barley is projected to stem from the expected increase in the pork and, especially the poultry sector. Russia is expected to remain a net-exporter for all main varieties of cereals and for sunflower seed as well. However, projections show a declining trend for cereals net-trade, while sunflower seeds are projected to keep a similar net-trade level throughout the projection period.

Figure 26: Soft wheat baseline outlook for Russia until 2025 (1000 t)

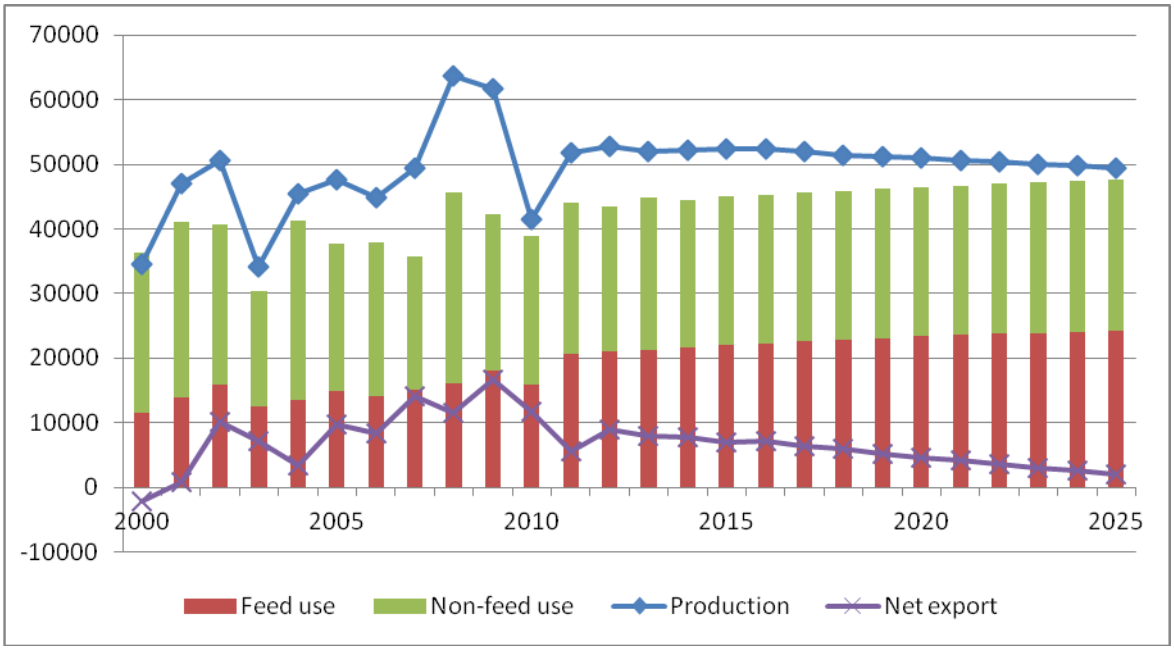
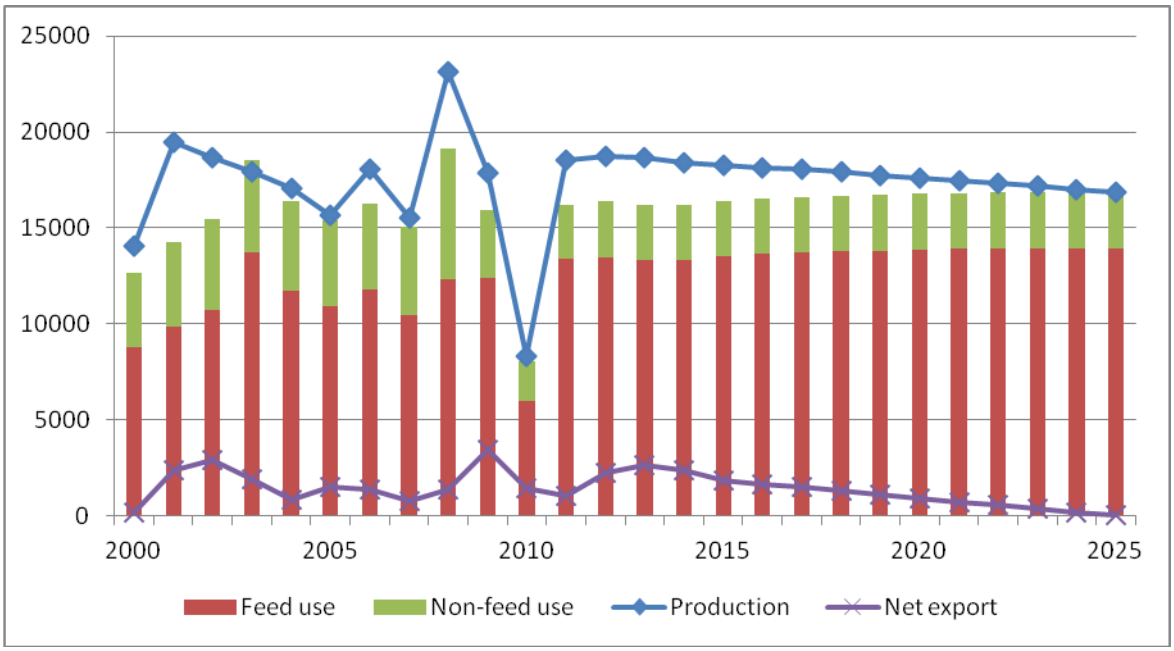


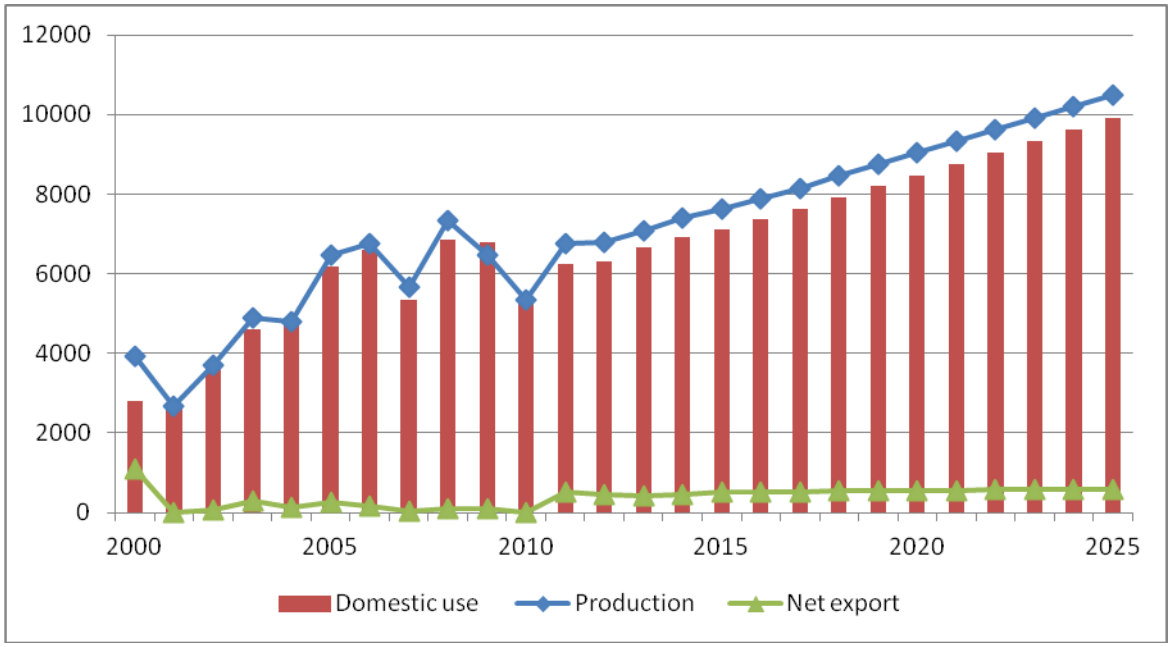
Figure 27: Barley baseline outlook for Russia until 2025 (1000 t)



Sunflower seed is by far the most important oilseed crop in Russia and the main product from crushers is vegetable oil. Russia's oilseed production is increasing since the beginning of the 2000s, mainly stimulated by the construction of large and modern crushing facilities, but also by the growing domestic demand for oilseeds. The projections follow this trend of the last decade and

depict a continuous increase in Russia's sunflower seed production and domestic use. It has to be mentioned that Russia's sunflower seed production reached a record high in 2011 with about 9.7 MMT, when the area planted with sunflower seed was considerably expanded, mainly due to dryness in early spring which prevented the sowing of spring wheat. However, our projections start with the year 2011 and are based on past trends, and therefore do not reflect this massive increase in Russia's sunflower seed production of 2011.

Figure 28: Sunflower seed baseline outlook for Russia until 2025 (1000 t)



Self-sufficiency

Although self-sufficiency rates are projected to decline in the course of time, Russia is expected to remain self-sufficient for the main cereals as well as for sunflower seeds and rapeseeds over the projection period. However, the self-sufficiency rates are projected to decrease. Especially the projected growth in the domestic livestock sector is expected to lead to increases of domestic feed which especially affects the self-sufficiency rates of barley and maize.

Almost no changes are projected in the self-sufficiency rates in the oilseeds sector. As in the past, the major part of sunflower seeds is expected to be sold on the domestic market for crushing.

Figure 29: Self-sufficiency rates (indices) for cereals in Russia

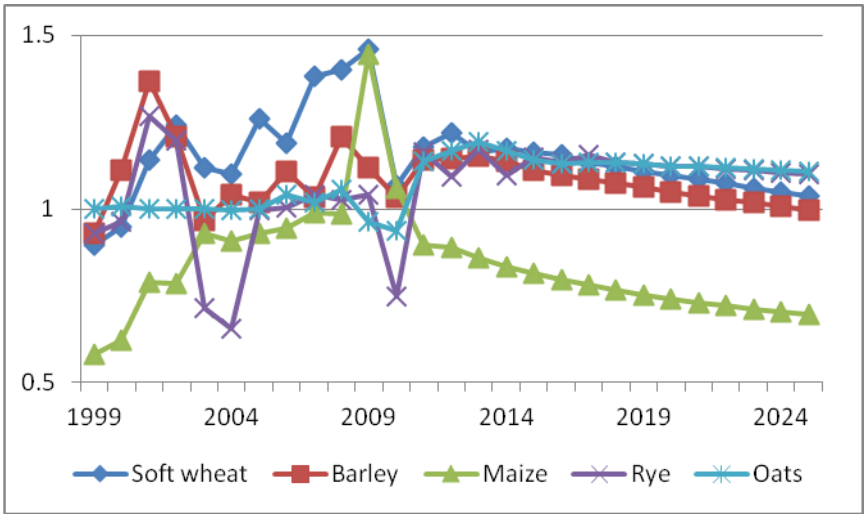
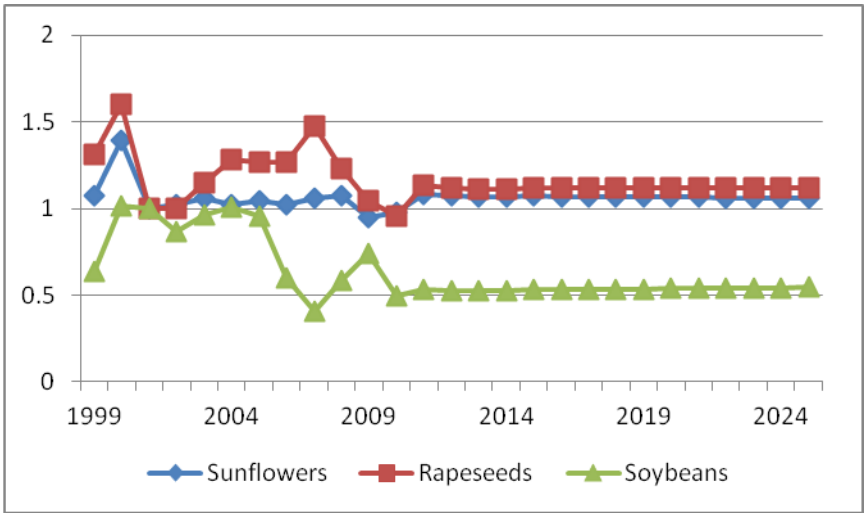


Figure 30: Self-sufficiency rates (indices) for oilseeds in Russia



4.2. Other crops

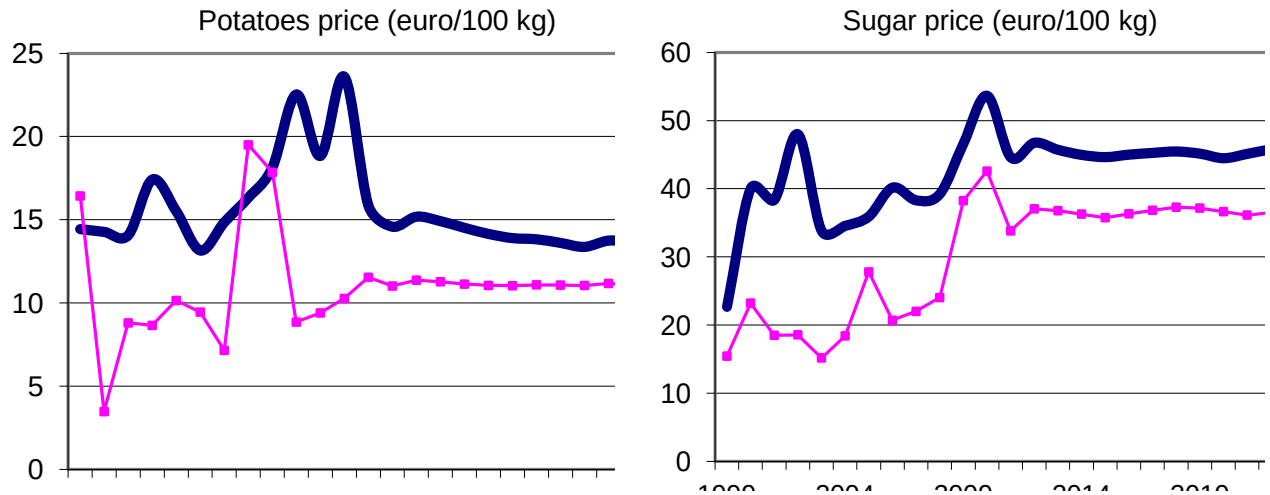
Besides grains and oilseeds the most important crops in terms of output value in Russia are sugar beets and potatoes. Both sugar beets and potatoes are usually not internationally tradable products.

Prices

The Russian potato and sugar prices are projected to remain above their respective EU prices (Figure 31). There are no trade barriers or support for potatoes. High transportation cost act more or less as natural trade barrier, and the fact that only a small share of Russian potatoes is sold on

the market may hinder price increases. On the other hand it can be expected that in the case of price increases also the share of production sold on the market could be increased. Russian raw sugar and white sugar are subjects to import tariff rates which allow the sugar price to surpass the world price.

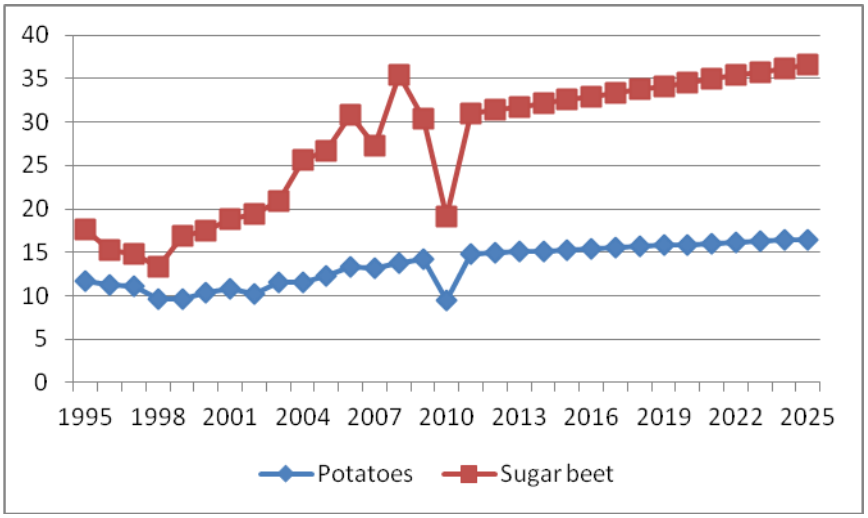
Figure 31: Potato and sugar prices in Russia, EU and the world (Euro/100 kg)



Yields per hectare

In contrast to other countries, Russian potato yields are quite stable. However, the statistics on potato yields could also be biased, as the low marketing level of potatoes makes it difficult to capture real average yields. Potato yields are projected to follow the stable trend of the past. Sugar beets yields have doubled during the last decade with the exception of the 2010 harvest when drought reduced it dramatically). However, sugar beet yields are still far below the EU average yields. Sugar yields are projected to constantly increase over the projection period, although at a lower rate than in the period between 2005 and 2008.

Figure 32: Potato and sugar beets yields per hectare in Russia (tonnes/ha)



Production, domestic use and net exports

The market projections for potatoes depict a decline in both production and consumption which follows a long-term development (Figure 33). As potato yields increased at the same time, area planted with potatoes is reduced under the baseline. In contrast, the outlook of production, domestic use and net-exports of sugar in Russia displays a growth driven by market prospects and policy support (Figure 34). The projected increase in sugar production is a result of both the state plan to obtain self-sufficiency in the foreseeable period and higher prices for sugar and related sugar beets prices.

Figure 33: Potatoes baseline outlook for Russia until 2025 (1000 t)

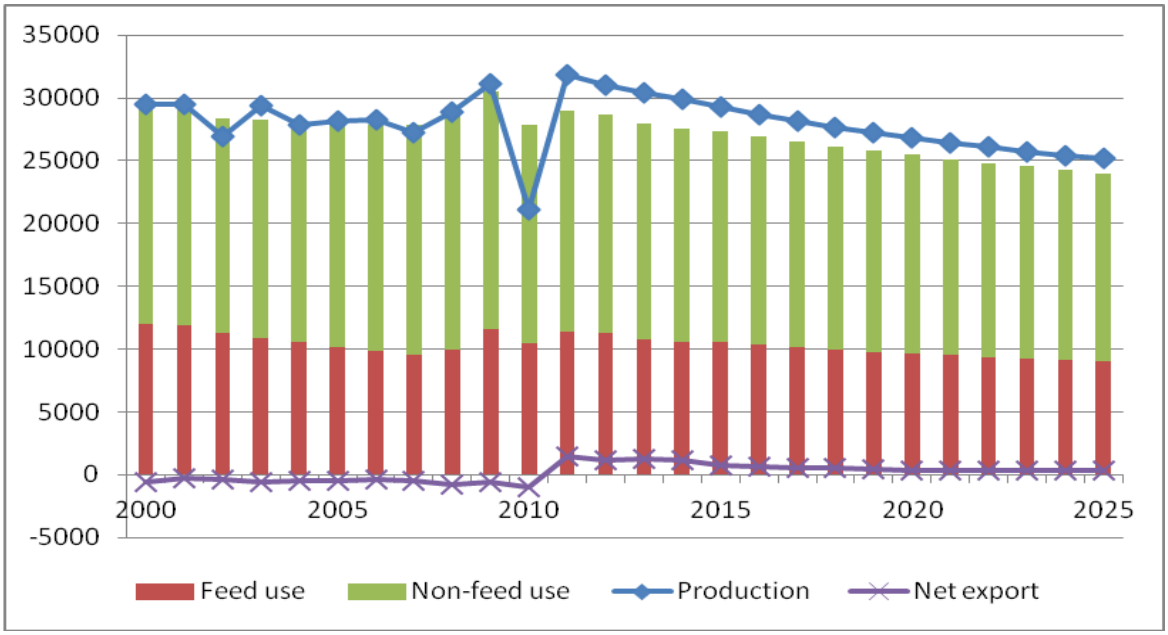
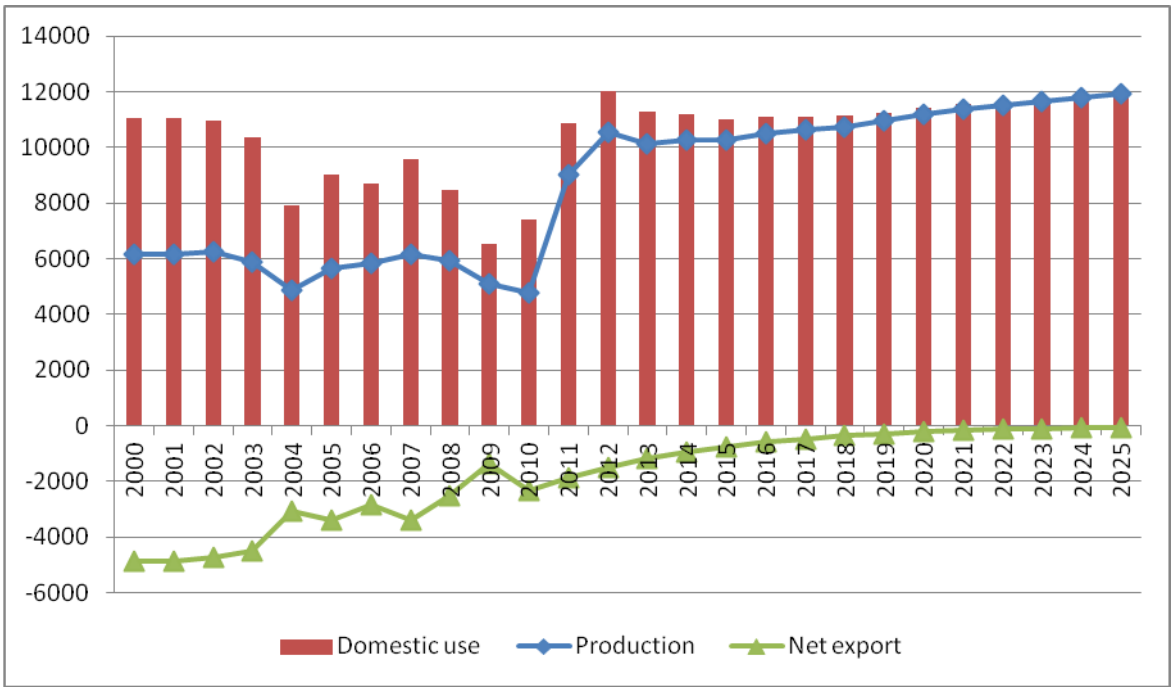


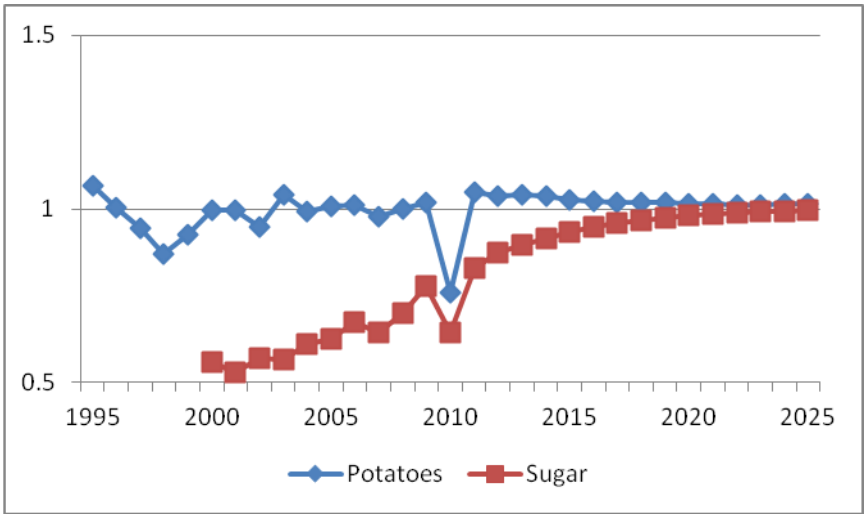
Figure 34: Sugar baseline outlook for Russia until 2025 (1000 t)



Self-sufficiency

Russia is projected to remain self-sufficient with potato production and projection results of the baseline indicate that Russia would come close to self-sufficiency in sugar production by 2025.

Figure 35: Self-sufficiency rates (indices) for potatoes and sugar in Russia

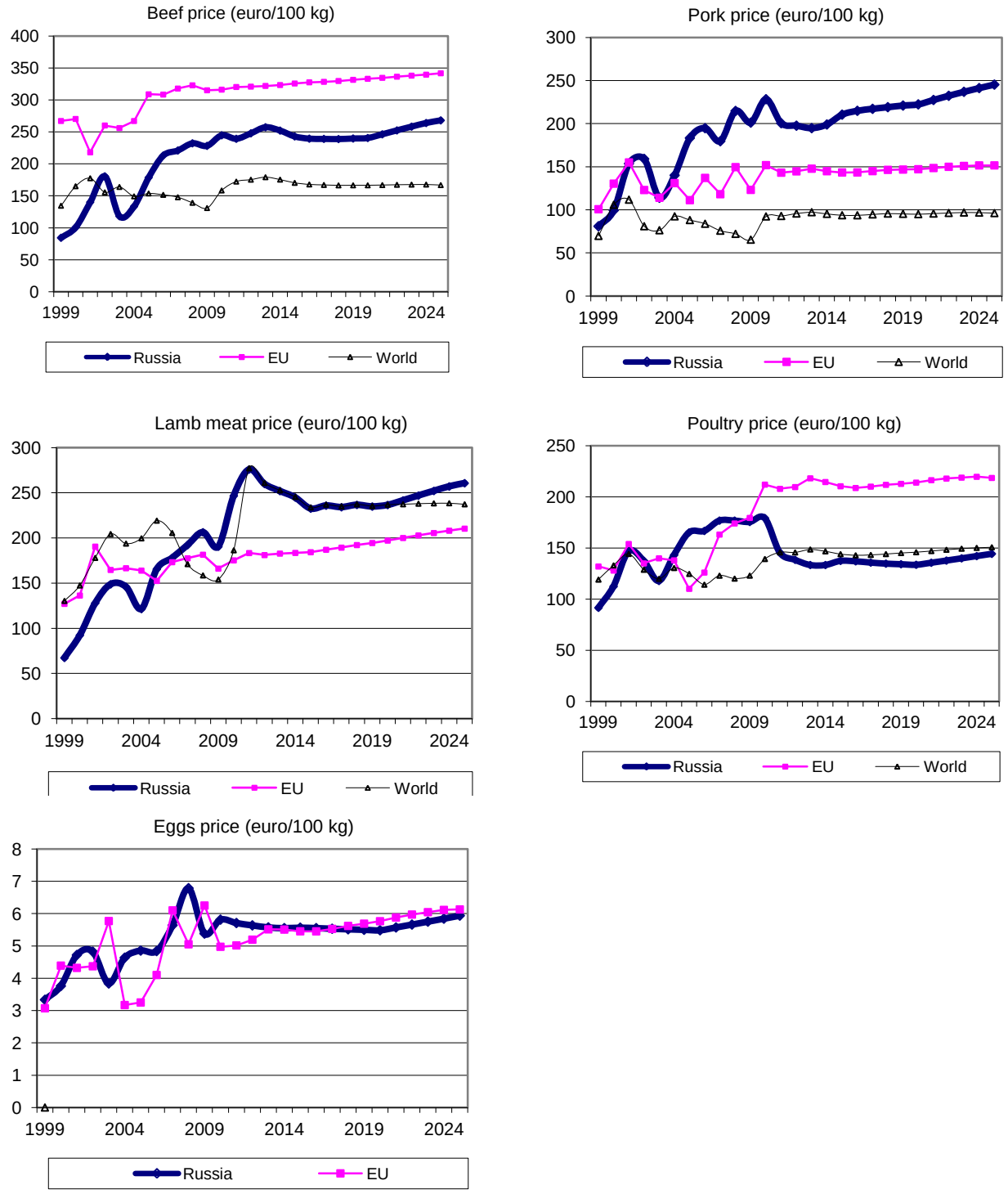


4.3 Meat markets

Prices

Although Russia applies import tariffs and tariff quotas for animal products to protect its domestic from the international market, Russia is a net-importer of all kind of meats. All domestic meat prices exceed their respective world market price levels (the only exception is lamb meat, where domestic prices had been below the world market prices during recent years). Russia's pork prices are even higher than EU prices. In the baseline projections, Russian beef prices are expected to remain significantly above the world market prices and under the EU price. Russian pork prices are projected to be above both the respective EU and world market prices. The projection results are influenced by the high net-import of beef and pork which occur due to higher demand based on economic growth. Prices for poultry start to decline in comparison to world market price levels as the poultry market is characterized by a balanced trade position.

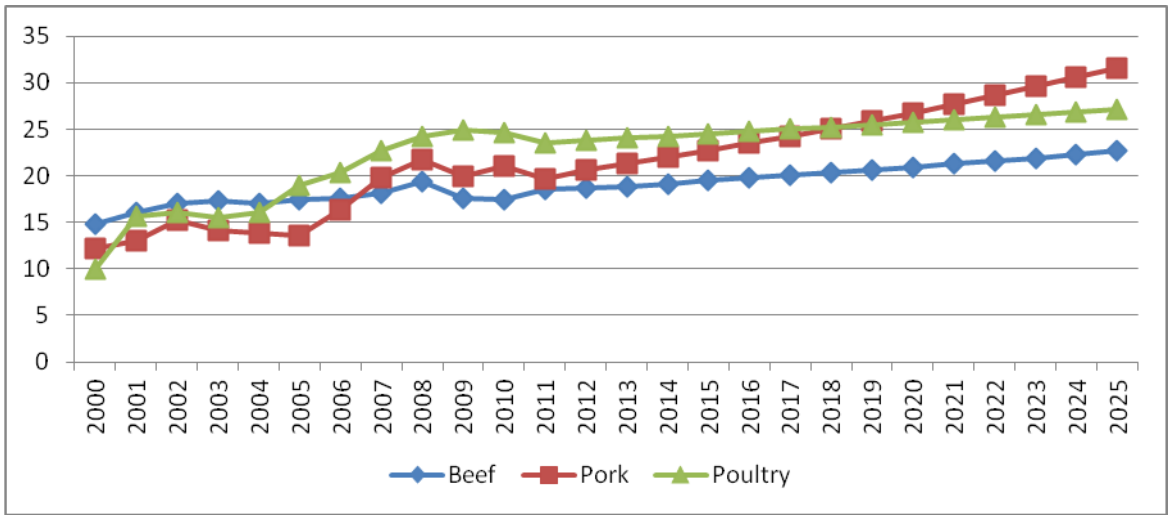
Figure 36: Meat and egg prices in Russia, EU and the world (Euro/100 kg)



Consumption, production, domestic use and net exports

Meat consumption per capita is projected to increase for all meats in Russia as income is rapidly growing. The strongest growth is expected in pork consumption, lowest in beef. Currently poultry is the most preferred meat due to lower prices compared to the other meats. However, over the projection period pork is projected to exceed poultry consumption per head.

Figure 37: Meat consumption per capita in Russia until 2025 (kg/capita)



Although the stimulation of livestock production is one of the major agricultural policy objectives in Russia since the 2000s, the support measures applied since 2006 did not lead to an effective change in the domestic beef sector. On the other hand, the support measures seem to have affected the pork and poultry sectors positively.

The beef baseline projections depict a further decrease in Russia's beef production, and as at the same time domestic use is expected to increase, Russia's net-trade position will further deteriorate over the projection period (Figure 38). Pork production is expected to further grow during the projection period, but at a lower rate as pork consumption. As a result, Russia's net imports of pork are projected to increase (Figure 39). Poultry production demonstrated a stable growth during the last decade and this trend is projected to continue over the baseline period. With production growing at a faster rate than consumption, Russia is projected to further improve its position as a net-exporter of poultry (Figure 40).

Figure 38: Beef baseline outlook in Russia until 2025 (1000 t)

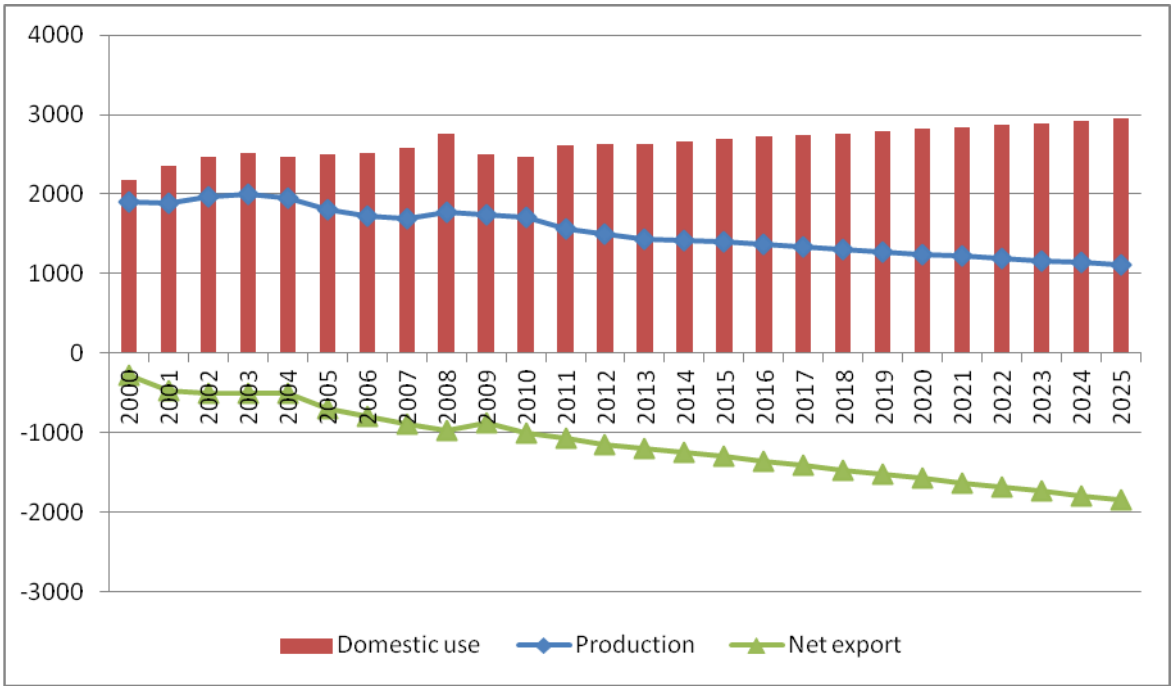


Figure 39: Pork baseline outlook in Russia until 2025 (1000 t)

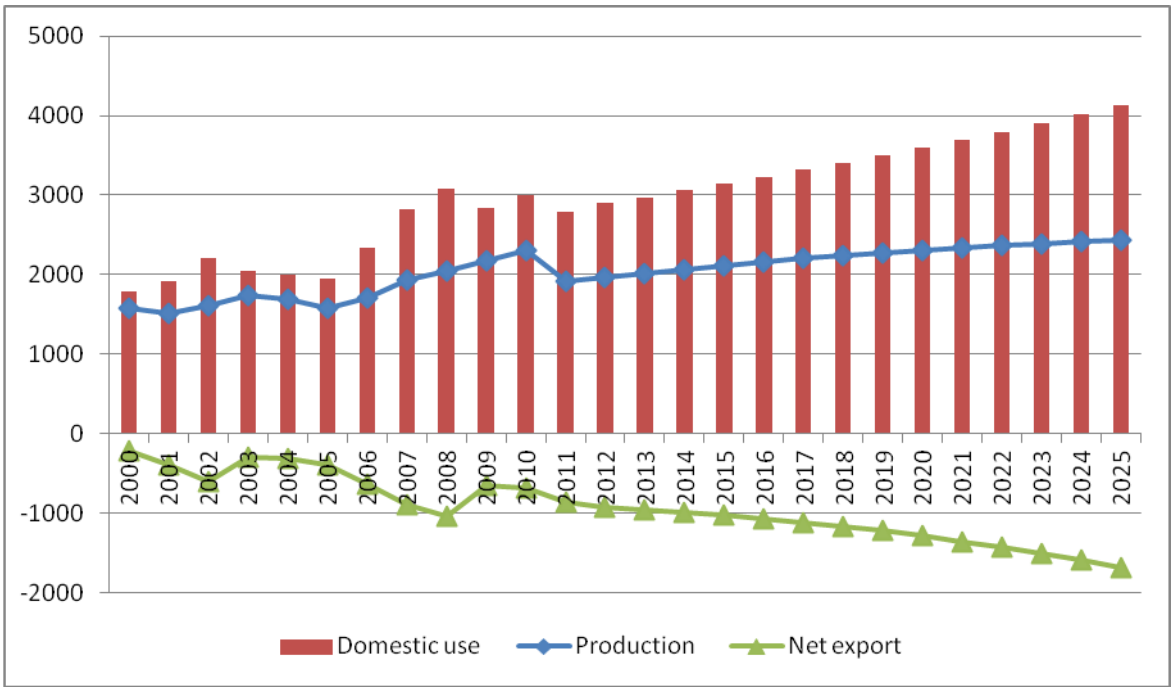
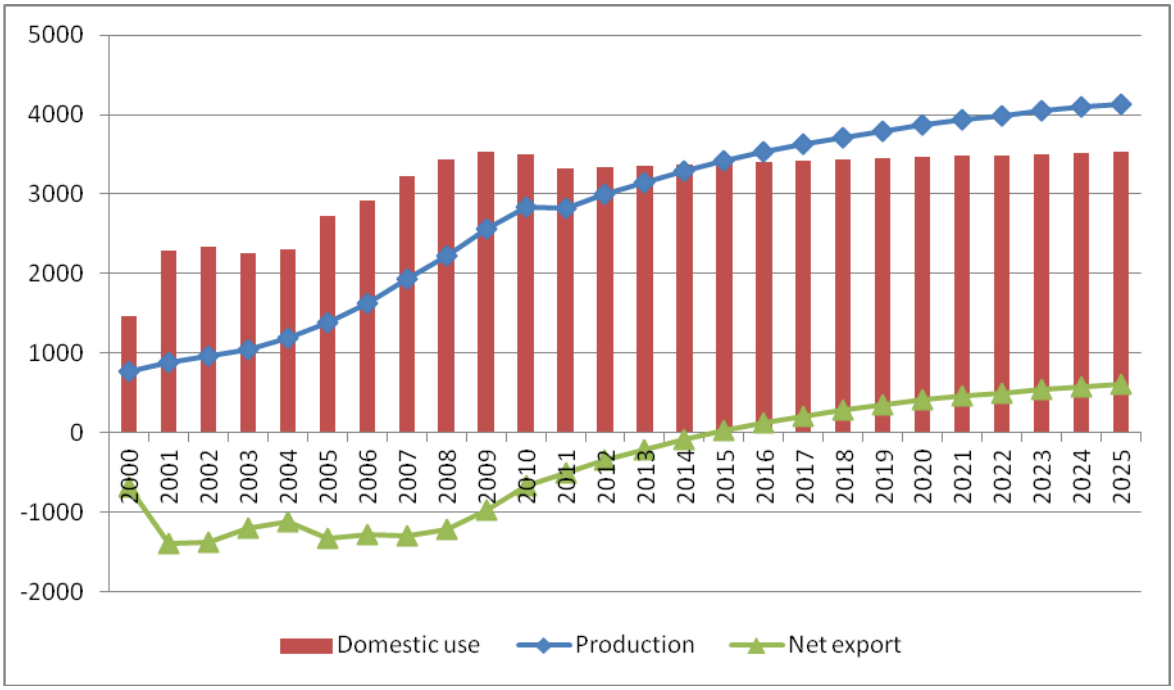


Figure 40: Poultry baseline outlook in Russia until 2025 (1000t)

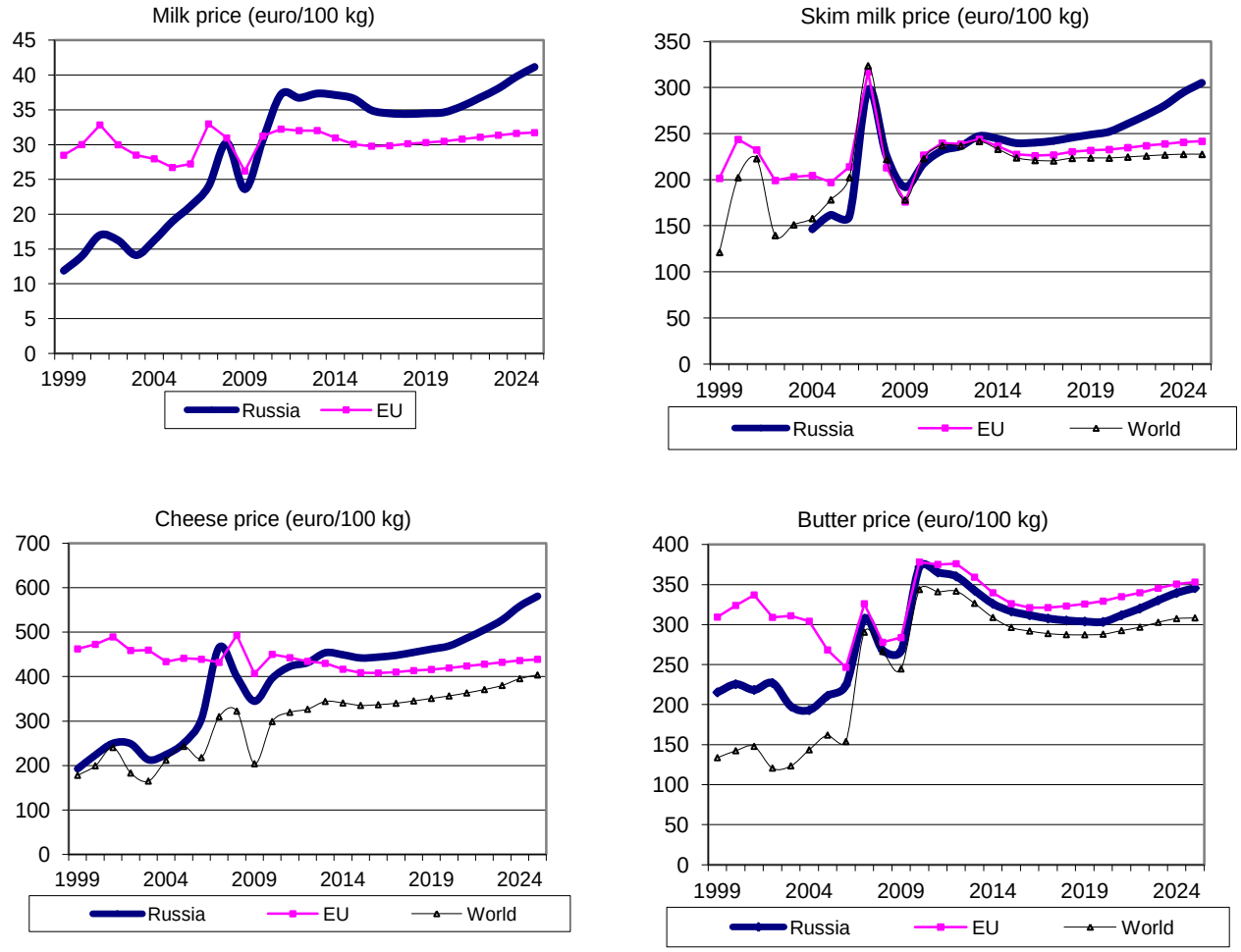


4.4. Milk and dairy products

Prices

Similar to other animal products in Russia, the share of milk sold at the market is quite low with 52%. Russia as a whole is a region with a deficit in milk production. Therefore, the trade figures indicate a net-import position and Russian milk price exceeds the EU price for milk; and EU and world market prices of skimmed milk powder and cheese prices follow the same patterns. Import tariffs are applied for drinking milk, cream, fresh dairy products, cheese and butter.

Figure 41 Milk and dairy product prices in Russia, EU and the world (Euro/100 kg)



Production, domestic use and net exports

Although Russian prices for milk and milk products are projected to increase, milk production is expected to more or less stable. Structural deficits and low milk quality hamper the improvement of the milk and dairy sector although the government provides some support. To change the overall situation most likely structural and infrastructure investments are needed. Russia is projected to remain a net-importer of all milk products. The following two figures show the market outlook projection for cheese and butter markets in Russia up to 2025. While in particular cheese demand is very expansive, butter consumption is decreasing slightly. This is reflected in a constant expansion of net-import of cheese, while net-import of butter remains rather stable during the projection period.

Figure 42: Butter baseline outlook in Russia until 2025 (1000 t)

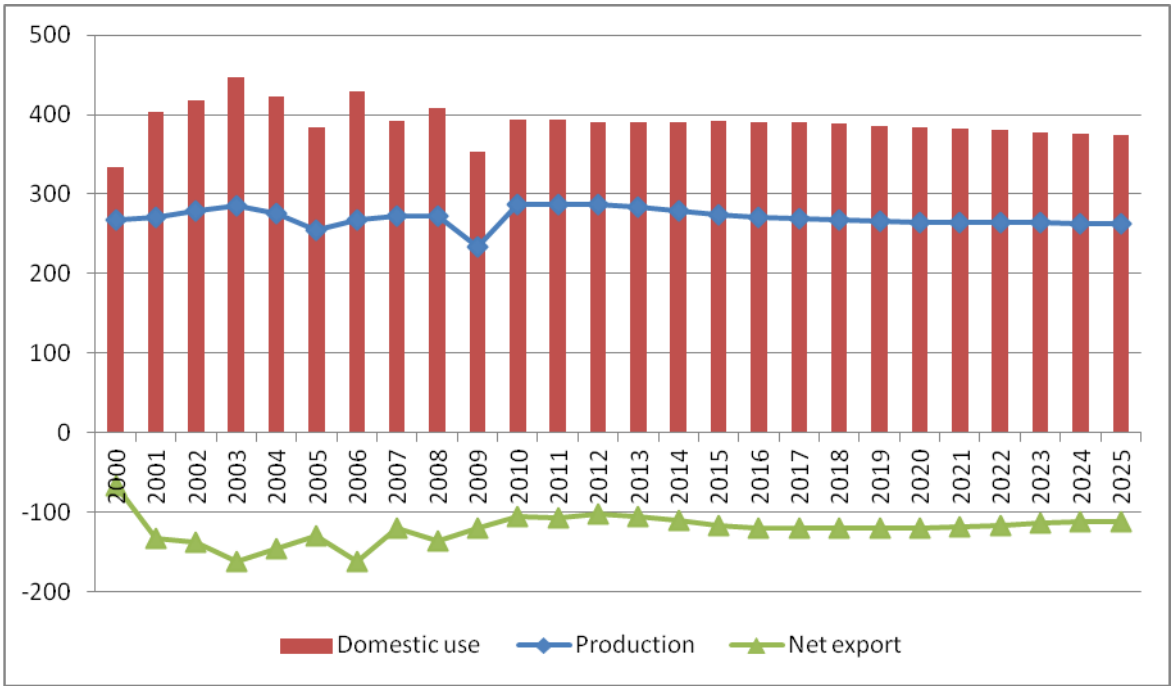
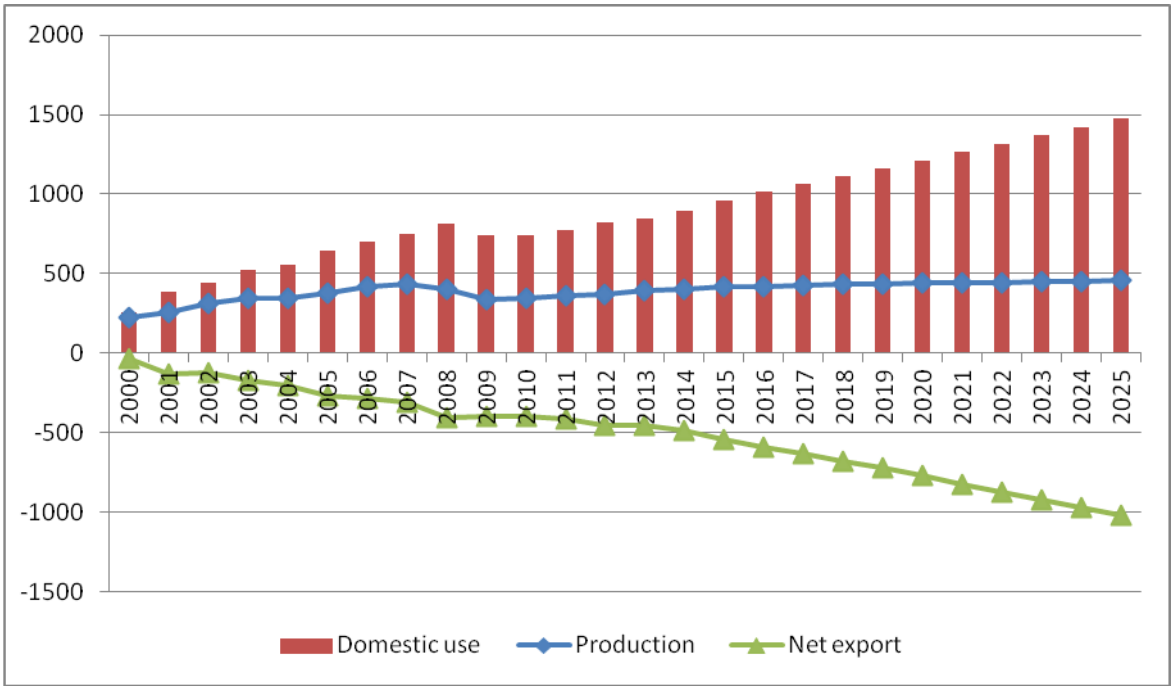


Figure 43: Cheese baseline outlook in Russia until 2025 (1000 t)



5. Concluding remarks

This final chapter presents some conclusions of the study with respect to the process of data compilation and parameter estimation, the conducted agricultural policy inventory and the main outcomes of the agricultural market outlook for Russia (section 5.1). Qualifications of the conducted study are given in section 5.2.

5.1. Main conclusions

AGMEMOD, a partial equilibrium economic model of EU agriculture at the Member State level has been used for this study. To establish the AGMEMOD country model for Russia, as for any other country, the implementation required parameter estimates of model equations, or in the cases when econometric estimation was not possible, the specification of synthetic model parameters. In order to estimate such model parameters and to build operational agriculture sector models a database with time series on Russia agricultural production, market balances and prices, macroeconomic variables and policy variables had to be developed. The following conclusions can be derived from the process of data compilation and parameter estimation:

- Russia is characterised by a differentiated agriculture that covers all sectors of the EU agriculture. There is a strong focus on plant production in general and on grain based animal production; however, Russia is a net-importer of animal products as well.
- Considerable knowledge is required to compile data of required quality for Russia, whereas long time series are needed to conduct parameter estimates. Changes in the data collection system of Russia may hamper the comparability of data through time. Consequently, the estimates are hindered by the presence of ‘structural’ and/or technical breaks.
- The regional governments in Russia apply local policies which impede a meticulous evaluation of policies across the different regions.

- Russian and EU data are sometimes difficult to compare to each other. Such differences and difficulties encountered in attempting to reconcile these data may hamper the closing of balances at the world level.
- Assumptions on future values of the macroeconomic factors significantly influence the simulation results. However, the quality of the applied assumptions is difficult to evaluate.
- Russia exhibit tremendous geographical stretches crossing different climatic zones. Infrastructure across large regions is difficult to maintain and may suffer some difficulties which may be reflected in high transaction cost. Thus the compilation and implementation of only one country price for each of those regions may only reflect part of the market interactions. A more detailed price system may provide deeper insights; however, to capture the trade interaction across the borders the chosen prices may enable a good first guess.

A detailed agricultural policy inventory and analysis was carried out whereas times series of Russia policy variables were compiled. This task proved to be particularly complicated as the collected policy information comes from a wide variety of sources. The collected information led to the following conclusions:

- Russian agricultural policy is more consumer than producer oriented.
- Russia has programs intending to improve self-sufficiency in certain sectors.
- Russian agricultural market policy has been subject to regular policy reforms. Furthermore, some of the policy adjustments occur in an ad-hoc manner to counteract unwanted market developments.
- Coupled and decoupled direct support is difficult to evaluate and often seem to have only limited impact on Russian production.
- The currently applied support prices are often buying-in prices set by state enterprises or cooperatives. Although such prices are not support prices from a formal point of view, they are expected to generate similar market impacts and thus have been modelled as such.
- Russian external agricultural and food trade is subject to import tariffs, tariff rate quotas, import bans, export tax, and export bans. However, if the import measures are applied in the case of commodities where Russia is a net-importer they may only increase domestic prices.

- For the future support amounts of coupled payments nominal value have been fixed in Euros, which is comparable to the AGMEMOD approach applied to EU Member States of the non-Euro area.

The main outcomes of the conducted baseline for Russia are as follows:

- Russian agriculture often can be characterized by a dichotomous structure. In the cereal and oilseed sector large farmers dominate the sector with regard to area and output, while meat production (except poultry and partially pork), milk, potatoes and vegetables production are more frequently based on small and semi-subsistence farms. Therefore the latter sectors are often poorly structured and relatively inefficient. All sectors are facing problems such as land erosion, shortage of water and drought. The loss of soil fertility is one of the reasons that the expected growth in yields over the projection period remains very limited in Russia. Even though abundant land is available for potential use, related cost to bring it into the production process would have to be covered.
- The baseline projections show that domestic prices in Russia for cereals and oilseeds will remain below their respective world market and EU price levels, which reflects also Russia's position as net-exporter for cereals and oilseeds. On the contrary, domestic prices of dairy products and pork are significantly above the respective EU and world market prices. Most other animal product prices are closer to the world market level. As a result, Russia is projected to remain a net-importer in all beef and dairy products. Production increases in the animal sectors seem to be limited, except in the vertically integrated large firms of the poultry production system.
- The baseline assumption that future policy variables remain as currently defined implies that the relationship between supply and demand on the Russian market does not change fundamentally.

5.2. Qualifications

As with all simulations and projections, the results of this report are based on several explicit and implicit assumptions. To the extent that such assumptions, ex post, are found to have been ill-

founded, the model outcome and the policy implications will be affected. The conditional nature of all projections should be recalled when looking at the results of the baseline projections for Russia. In this context, following points have to be emphasised:

- Although the latest available projections concerning the macroeconomic variables (especially GDP growth, population, inflation rate, exchange rates) have been used when the simulation was conducted, in the face of the ongoing global economic turmoil considerable uncertainties remain with respect to the future economic prospects. In addition to the uncertainties related to GDP growth, also the future development of exchange rates between the Euro and other EU currencies as well as other currencies of non-EU countries are hard to forecast. Effects on the Russian currency are even more difficult to judge.
- Energy prices are not explicitly represented in AGMEMOD, but in this area uncertainty exists with respect to the development of the future oil prices, which affect the prices of a wide range of agricultural inputs and outputs.
- No bioenergy sector has been considered for Russia.
- Concerning the endogenous price formation policies in the ROW are not modelled and the price wedge between cif and fob are not covered, yet and may have impacts on the future model scenario outcomes. A more detailed assessment of the applied parameters and technical progress may also yield better insights into drivers.
- The new ROW's production and consumption is determined directly by world prices without any wedges between world and producer or consumer prices. Another simplification is that the parameters of the behavioural supply and demand equations have not been estimated econometrically, but are mainly derived from other existing partial equilibrium models, e.g., ESIM or FAPRI.
- The domestic price formation in the dairy sector needs to be revised to enable dairy world market prices to be endogenized in future.
- Another issue in the AGMEMOD model relates to the assumption of commodity homogeneity. In reality many of the price spreads observed are due to quality differences between commodities. There is only one price per commodity that is used as the key price, although the product in question can be very heterogeneous across countries. The same

problem is applicable to Russia, the regional price spreads already occurring in the present situation;

- Weather conditions are assumed to be normal, i.e. reflecting long-run averages. As weather varies constantly from the average, also agricultural prices will fluctuate around the projected levels, depending on the weather deviation. Weather events and associated yield, production and price volatility that can be reasonably expected to happen at some point over the projection period are assumed not to occur. This holds true not only for Russia but also for the ROW. Therefore the projections show rather smooth developments, whereas in reality it is very likely that the markets show more volatility.

Russia is a member of the WTO since 22 August 2012. However, the simulations for the outlook have been conducted in the beginning of 2012 and therefore Russia's accession to the WTO and the associated commitments are not taken into account. Accordingly for the baseline projections the Russian border policy applied to protect Russian agriculture - which reflects a package of import tariffs, export quota and export taxes - is assumed to be applied unchanged up to 2025. How does the WTO agreement affect the projections of the Russian agricultural outlook? First results of a WTO accession scenario conducted with the AGMEMOD model indicate, that the WTO commitments might especially affect prices in the livestock sector of Russia. As Russia will have to lower its market interventions especially in the pork sector, this is projected to result in lower production increases in the sector and augmented meat imports. Lower livestock production in Russia implies lower domestic demand for feed grains which is projected to have also impeding effects on the production growth in Russia's grains sector; however grain exports are projected to increase.

It also has to be pointed out that results of the latest OECD-FAO (2012) agricultural outlook are generally far more optimistic than our projections with regard to growth in Russia's agricultural production. In our projections, growth in agricultural production follows recent time paths and in recent years Russia's cereal sector was negatively affected by several domestic policy interventions which limited exports. These policy interventions constituted a disincentive for Russia's cereal producers, provoking a shift from cereals to oilseeds production (as in the latter no or at least less, policy interventions took place). This trend is carried forward throughout the

projection period. Consequently our projections might be rather conservative with respect to production increases. As outlined throughout the report, Russia has considerable potential for agricultural production and growth, and our projection results would certainly be altered if Russia is able to solve some of the underlying problems that limited the development of its agricultural sector in the recent past.

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7. Annex: Description of mathematical equations and associated data files

Note: As both the Russian and the Ukrainian country models follow the same AGMEMOD approach, the description given in this annex is the same as presented in the Ukraine report (Leeuwen et al., 2012).

Conceptual model

AGMEMOD uses a bottom-up approach. Based on a common country model template, country level models have been developed reflecting the specific situation of the agricultural sectors in the individual countries. As a next step, these country level models have been integrated into a composite EU model. The approach adopted allows for the capture of the inherent heterogeneity of agricultural systems existing within the EU, while simultaneously maintaining analytical consistency across the estimated country models. In principle, the implementation of Russia into AGMEMOD was conducted along the same procedures as described in this section and this approach results in the AGMEMOD 5.0 version.

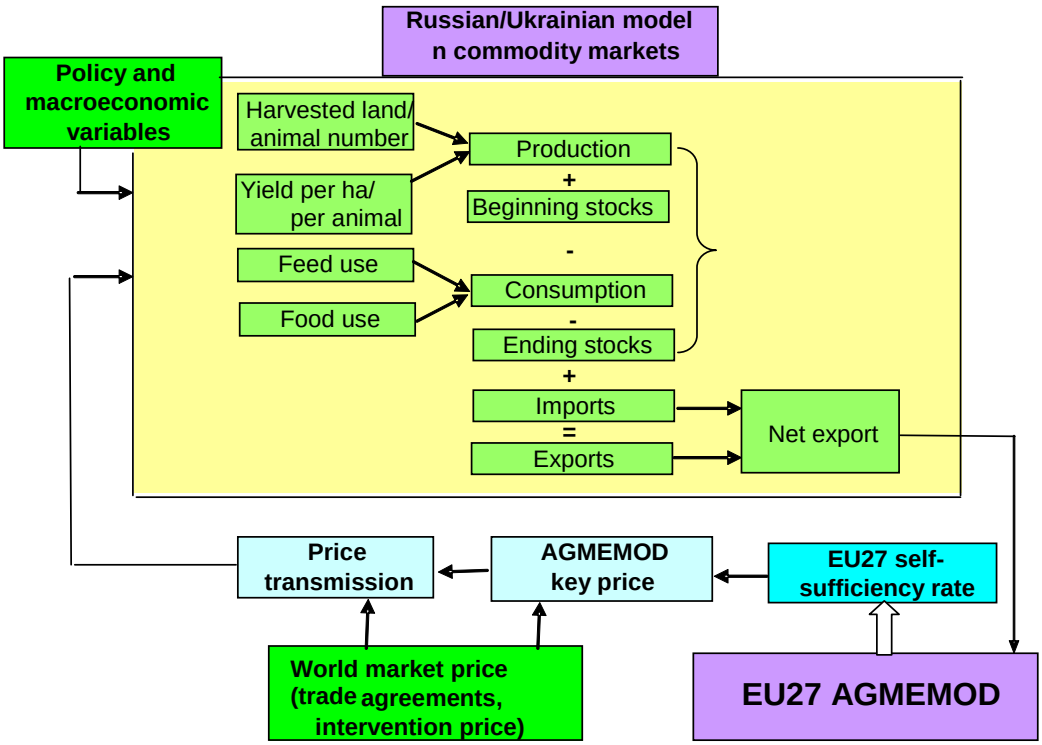
Analytical consistency is achieved by adhering to the common AGMEMOD templates for the Russia model to be estimated. The incorporation of Russian agricultural policy instruments in a harmonized fashion allows the AGMEMOD 5.0 model to analyse trade policy relevant questions and the impact of possible trade policy changes at the Russian, EU Member State and aggregate EU levels, in an internally consistent and transparent fashion. This analytical consistency across the country models is an essential pre-condition for a successful integration of the Russian model within the combined AGMEMOD framework.

The Russian model consists of different supply and market modules for those commodities that represent the majority of the product coverage of these countries. In general, cereal and oilseeds with their derived products (oils and cakes), sugar beets, potatoes, livestock (cattle, beef, poultry, sheep and goats) and dairy (raw milk, fluid milk, butter, skimmed milk, cheese, and whole milk powder) are modelled. For each of these commodities, production as well as supply, demand,

trade, stocks and domestic prices are derived by econometrically estimated or calibrated equations. One element of the supply and demand balance, for each commodity modelled, is derived as a closure variable. Figure 1 illustrates the modelling structure of commodity markets at the Russian country level, with exports assumed to be the supply and demand balance ensuring closure variable.

To ensure that the projections of the Russian model make economic sense and are coherent from a policy perspective, the projections are validated by standard econometric methods and through consultation with experts who are familiar with agricultural markets in Russia. From this perspective, the performance of the Russian commodity market models in analysing trade impacts has primacy in the evaluation of the modelling system's performance.

Figure 44: AGMEMOD structure for Russia

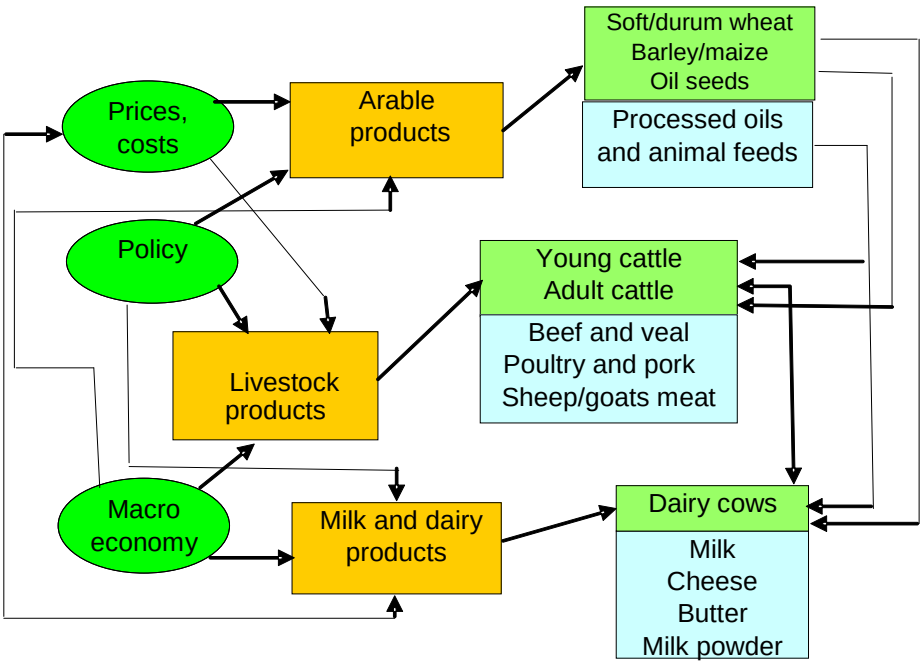


In order to simulate trade measure effects, the focus is on adjustments of trade policy measures between Russia and the EU and the ROW in comparison with a counter factual situation where the currently known trade policy measures are taken into account.

The various agricultural commodity markets of Russia are linked to each other by substitution or complementary parameters in production or consumption. Furthermore, interactions between the crops and livestock sub-models are captured via the derived demand for calves and feed (Figure 45).

The next part of this section describes the Russian AGMEMOD commodity market structures for crops, livestock and livestock products, milk and dairy products, respectively, following the common AGMEMOD structures as can be found in Chantreuil et al. (2011).

Figure 45: Linkages between commodity markets in the Russian model



Crops

In the crop models for grains, oilseeds and root crops (potato and sugar beets), land is allocated in a two-step process. In the first step, producers' behaviour determines the total land area used for grains, oilseeds, and root crop culture groups (i). In the second step, the shares of the total land area devoted to the nested commodity groups (grains, oilseeds, and root crop cultures) are allocated for each culture k of the corresponding culture group (i).

The equation for total area harvested for grains, oilseeds and root crops is written as:

$$ah_{i,t} = f\left(p^k_{i,t-1}, ah_{l,t-1}, V\right) \qquad k = 1,\ldots,n; \quad i,l = 1,\ldots,3; \quad i \neq l \qquad (1)$$

Where $ah_{i,t}$ is the area harvested in year t for culture group i, $p^k_{i,t-1}$ is the real price in year $t-1$ of culture k belonging to culture group i, and V is a vector of exogenous variables which could have an impact on the area of culture i that is harvested such as, e.g., inter alia, the support premiums and quota. The share of culture k belonging to the nest i ($sh^k_{i,t}$) is written as:

$$sh^k_{i,t} = f\left(R^k_{i,t-1}, sh^k_{i,t-1}\right) \qquad k = 1,\ldots,n \qquad (2)$$

where $R^k_{i,t-1}$ are the gross returns for culture k. The yield equation of culture k in the culture group i is written as:

$$r^k_{i,t} = f\left(p^k_{i,t-1}, ah_{l,t}, V\right) \qquad k = 1,\ldots,n \qquad (3)$$

where $r^k_{i,t}$ is the yield per hectare of culture k belonging to the culture group i, and V is a vector of variables which may impact on the yield per hectare of the culture k modelled, including a trend.

For demand, in principle three uses are distinguished, namely crushing, feed demand and non-feed use (modelled on a per capita basis) by using the following general functional forms:

$$Fu^k_{i,t} = f\left(p^n_{i,t}, Z\right) \qquad k = 1,\ldots,n \qquad (4)$$

where $Fu^k_{i,t}$ is the feed demand for culture k belonging to the culture group i, $p^n_{i,t-1}$ is the real price in year $t-1$ of each culture k (1,…,n) belonging to culture group i and Z is a vector of endogenous variables, which could have an impact on the use considered, such as the milk and meat production.

$$NFu^k_{i,t} = f\left(p^j_{i,t}, V\right) \qquad k = 1,\ldots,n \qquad (5)$$

where $NFu^k_{i,t}$ is the non-feed demand for culture k belonging to the culture group i, and V is a vector of exogenous variables which may influence the non-feed demand of culture k modelled, such as the income per capita and the population. Crushing of oilseed culture k ($CR^k_{i,t}$) is modelled as:

$$CR_{i,t}^{k} = f\left(p_{i,t-1}^{h}, p_{i,t-1}^{h}, p_{i,t-1}^{l}, VZ\right) \qquad h, l = 1,\ldots,n \qquad (6)$$

where $p_{i,t-1}^{h}$ is the real price of oil produced and $p_{i,t-1}^{l}$ the real price of the meal produced as both are products of the crushing process. VZ is a vector of exogenous and endogenous variables which may influence the crush demand such as import, production, extraction rates.

Generally, stocks, export and import equations within the crop model have the following functional forms:

$$St_{i,t}^{k} = f\left(PR_{i,t}^{k}, DU_{i,t}^{k}, St_{i,t-1}^{k}, VZ\right) \qquad (7)$$

$$Ex_{i,t}^{k} = f\left(PR_{i,t}^{k}, DU_{i,t}^{k}, Ex_{i,t-1}^{k}\right) \qquad (8)$$

$$\mathrm{Im}_{i,t}^{k} = f\left(PR_{i,t}^{k}, DU_{i,t}^{k}, \mathrm{Im}_{i,t-1}^{k}\right) \qquad (9)$$

where $\mathrm{Im}_{i,t}^{k}$, $Ex_{i,t}^{k}$ and $St_{i,t}^{k}$ are the ending stocks, exports and imports for culture k respectively, belonging to the culture group i in year t. $PR_{i,t}^{k}$ and $DU_{i,t}^{k}$ are the production and the total domestic use of culture k belonging to nest i. VZ is a vector of exogenous and endogenous variables, such as support prices and price of the culture produced.

Also, the respective markets for the processed commodities are included. The supply sides of these markets are provided for by crushed quantities and technical coefficients. The specification of equations for exports, imports, stocks, oil consumption per capita, industrial demand for oil and meal domestic use follow the approaches of equations (4.7), (4.8), and (4.9).

Livestock and livestock products

The structure of individual livestock and meat sub-models can vary. However, each animal sector sub-models follow a comparable structure which is presented below. Ending numbers of animals are modelled as:

$$cct_{i,t} = f\left(cct_{i,t-1} p_{i,t}, V\right) \qquad i = 1,\ldots,n \qquad (10)$$

where $cct_{i,t-1}$ is the ending stock in year $t-1$, $p_{i,t}$ is the real price in year t of the animal i, and V is a vector of exogenous variables which affect the ending stocks such as premium payments.

Numbers of animals produced by the inventory of breeding stock is given by the following equation:

$$spr_{i,t} = f(cct_{i,t-1}, ypa_{i,t}) \qquad i = 1,\ldots,n \qquad (11)$$

where $spr_{i,t}$ is the number of animals produced from the herd $cct_{i,t}$ in year t and $ypa_{i,t}$ is the yield per animal concerned.

$$ypa_{i,t} = f(ypa_{i,t-1}, p_{i,t-1}, r_{i,t}, ra_{i,t}, V) \qquad i = 1,\ldots,n \qquad (12)$$

where $r_{i,t}$ is the long-term return of animal i and $ra_{i,t}$ is the adjusted long-term return if decoupled direct payments are to be considered. Decoupled payments are included via reaction prices (euro/100 kg) that account for available hectares, livestock density per hectare, animal stocks and slaughtering weights per animal.

Normally within each animal culture i there can be m different categories of slaughtering j, however, the Russian and Ukrainian data only allow for one category of slaughtering. The slaughtering of animal culture i can be written as:

$$ktt_{i,t} = f(cct_{i,t}, p_{i,t}, z_{i,t}, V) \qquad i = 1,\ldots,n \qquad (13)$$

where $ktt_{i,t}$ is the number of slaughtering of animal culture i in year t, $z_{i,t}$ is an endogenous variable that represents the share of the slaughtering of the animal culture concerned, and V is a vector of exogenous variables, such as policy instruments.

Average slaughter weight per animal culture i can be written as:

$$slw_{i,t} = f(slw_{i,t-1}, z_{i,t}, p_{i,t}, V) \qquad i = 1,\ldots,n. \qquad (14)$$

To derive the total meat production of animal i, the average slaughter weight is multiplied by the total number of animals slaughtered.

Total ending stocks of animals and meat production are calculated as identities. Total domestic use of meat is calculated as the product of per capita demand times the exogenous population variable. Per capita consumption of meat itself is determined as:

$$upc_{i,t} = f(upc_{i,t-1}, p_{i,t}, p_{k,t}, gdpc_t, V) \qquad k, i = 1,\ldots,n;\ k \neq i \qquad (15)$$

Where $upc_{i,t}$ is the per capita consumption of meat i in year t, $gdpc_t$ is the real per capita income and V is a vector of other exogenous variables that have an impact on per capita meat consumption. The functional form for estimating the ending stocks of meat has the same general form as the animal breeding inventories in Equation (4.10). Furthermore, the specifications of the trade equations for animals and meat resemble the general functional forms used in the grains and oilseeds models in Equations (4.7)-(4.9).

Milk and dairy products

The dairy sub model is more complicated due to the fact that the allocation of raw materials to dairy products is done on the basis of fat and protein rather than on the basis of raw milk. The exception is fresh milk use, which is still modelled on a raw milk basis in the model. Dairy products covered by the Russian and Ukrainian AGMEMOD models are fluid milk, cheese, butter and milk powder. In the first step, raw milk production, raw milk imports and exports are determined. In the second step, raw milk for feed use and fluid milk consumption are estimated with the remaining raw milk available for factory use (manufacturing milk) in the form of milk fat and milk protein for further processing. Governed by a series of equations, the usage of fat or protein itself determines the quantity of the respective dairy products manufactured. For the different commodities, the residual or balancing product uses are determined as they are in other markets by using Equations (4.7)-(4.9) and (4.15). The milk production equation has the following specification:

$$spr_t = f(p_t / ict_t, r_t, ra_t, V) \qquad (16)$$

where spr_t is the milk production in year t, p_t is the real price of milk, ict_t is the milk production cost (or index) in year t and V is a vector with exogenous variables which may influence the milk production, such as milk supports. Milk yield per cow ypc_t can be written as:

$$ypc_t = f(p_t, ict_t) \qquad (17)$$

Dairy cow ending numbers are derived from Equations 15 and 16, while total milk production is calculated as the product of milk yield per cow and total ending cow numbers.

As noted above, total milk production is allocated to three uses, namely feed use (ufe_t), fluid use on farm (ufl_t), and factory use (ufa_t). Feed use is kept constant. Fluid use on farm can be written as:

$$ufe_t = f(p_t, V) \qquad (18)$$

with fluid use derived as per capita fluid milk consumption multiplied by population. Factory use of milk is derived as the balancing element that ensures balance between total milk supply and use. The factory use of milk determines the available fat and protein supply used in the manufacturing sector. Here, a number of assumptions have to be made concerning the fat and protein content of the raw milk and dairy commodities, because actual data on milk usage in milk products are unavailable or inconsistent. Instead, fat and protein contents of standard products are applied (e.g., 82% milk fat content in butter).

In the next step, milk fat is allocated to the different dairy commodity processing lines, whereas the amount for each final product is estimated. Then, the protein content will be defined by the level of manufacturing (e.g., cheese produced) by an identity which reflects the fixed nature of the protein to fat ratio in that product. Due to unavailable data, these ratios are assumed and calibrated to the observed production. In principle, the fat allocation to a dairy commodity i can be written as

$$fpc_{i,t} = f(fpc_{i,t-1}, p_{i,t}, p_{k,t}, V) \qquad i,k = 1,\ldots,n;\ i \neq k \qquad (19)$$

Where $fpc_{i,t}$ is the allocation of fat to a dairy commodity i in year t, $p_{i,t}$ is the price of dairy commodity i, and V is a vector of exogenous variables that affect the fat allocation to commodity i. Total fat available is distributed directly or indirectly to n dairy commodities, but only $n-1$ fat allocations are estimated, as allocation to the nth product is determined as a balancing residual. Consequently, production of dairy commodity *i* including fat is calculated as total milk fat use for commodity *i* divided by fat content of the dairy commodity *i* which is a technical coefficient. The allocation of milk protein is determined by identities.

Market balancing

To complete the building of the Russian AGMEMOD commodity sub-models, it is necessary to add an equation describing the equilibrium for each commodity market. This condition implies

that production plus beginning stocks plus imports must equal domestic use plus ending stocks plus exports. In a closed economy, this supply and use equilibrium condition (less the import and export components) is sufficient to endogenously determine the equilibrium country market prices. Given that Russia does not represent closed economies, the rest of the world can have important impacts on their modelled economies. To account for such impacts we have chosen to use price linkage equations to represent the inter-relationship across Russia and the ROW. The price linkage equations in the baseline are written as:

$$p_{i,t} = f\left(Wp_{i,t}, ssr_{i,t}, V\right) \qquad (20)$$

Where $p_{i,t}$ is the price of the Russian commodity i in year t, $Wp_{i,t}$ is the world market price of commodity i in year t, $ssr_{i,t}$ is the self-sufficiency ratio (production divided by domestic use) for commodity i in Russia, and V is a vector of exogenous variables which could have an additional impact on the Russian national prices, such as the Russian support prices and Russian border protection measures.

To ensure that the projections of the Russian models make economic sense and are coherent from a policy perspective, the projections are validated by standard econometric methods and through consultation with experts who are familiar with agricultural markets in Russia.

Computable model

In general, the building of models and the writing of properly structured software must go hand in hand. If software is poorly structured, in particular the making of changes to simulation models might become a tedious, error prone and time consuming process. On the other hand, properly organized and documented software contributes to the model's flexibility, extendability, reproducibility and transferability. Mostly, simulation models tend to be adjusted time after time for each research project in order to provide answers on new questions and thus lead to new model versions. In the course of model time, however, it might become unclear what the original computer model actually had to produce and the consistency between conceptual model and actual computer model might be hampered. To restrict these types of problems, both conceptual model builders and IT-scientists work together in the AGMEMOD project. Figure 3 illustrates the global procedure applied to the Russian and Ukrainian AGMEMOD models and, in principle, to the stylized ROW module from the data preparation, the estimation of equations and the

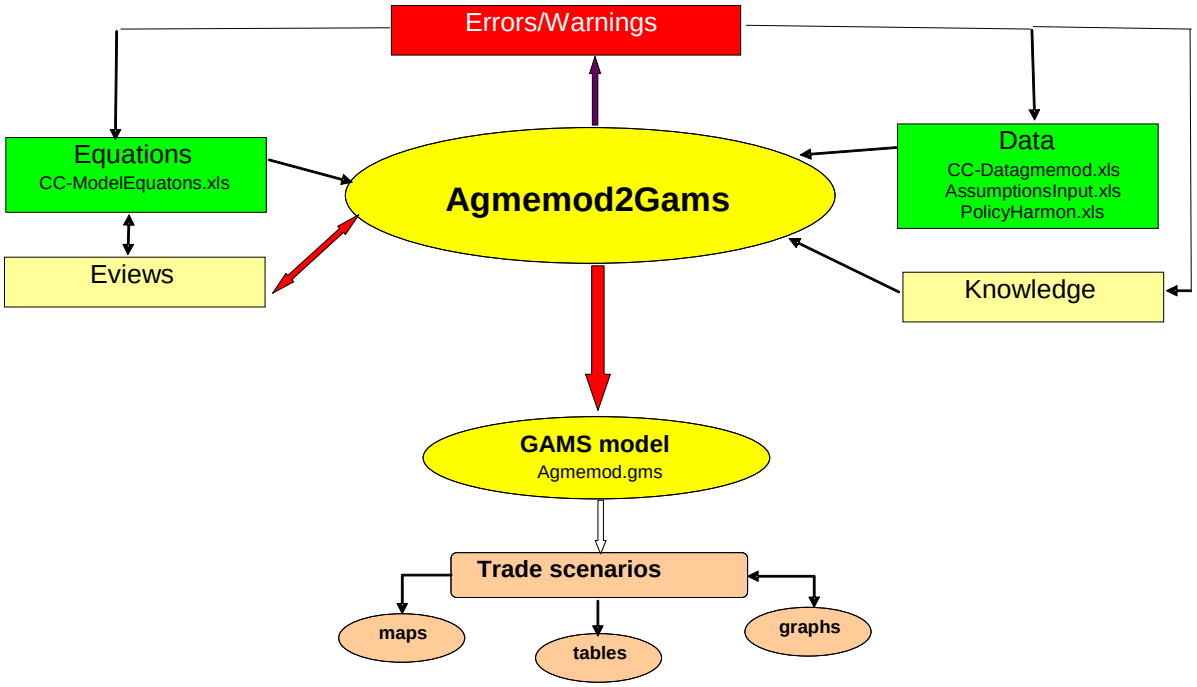
generation of GAMS framework towards the model solving and the trade scenario analyses processes. The green boxes refer to the input needed such as the assembled data and the equations to be estimated, while the ovals refer to the AGMEMOD software that has been built to guide that process. In general, the procedure works as follows: First, all common exogenous data (stored in the MS-Excel files *AssumpitonsInput.xls* and *PolicyHarmon.xls*) and specific country data (stored in the MS-Excel files *RU-Datagmemod.xls* and *UA-Datagmemod.xls*) are read to create the comprehensive dataset that is required to solve the combined model. Second, the dataset is integrated with the estimated equations on the country level (stored in the MS-Excel files R*U-ModelEquations.xls* and *UA-ModelEquations.xls*). Then, solutions for all markets, years and countries are sought and model results are exported to output files (MS-Excel and GDX files). These result files capture the projections of agricultural activity levels (areas harvested, livestock numbers), supply and use balances (production, domestic use, imports, exports and ending stocks) and prices on the country and EU levels.

To implement the conceptual Russian and Ukrainian AGMEMOD modules into actual computer models and integrate them with the countries currently involved in the AGMEMOD framework, GAMS software is used. To make the computer version transparent and accessible, it has been structured on the base of *Gtree*, which stands for *GAMS tree* and can be considered as an alternative of the GAMS-IDE (Dol, 2006). In practice, this *Gtree* framework enables the AGMEMOD user to manage and understand the model. More precisely, the *Agmemod2Gams tool* has been specially developed with the objective of guaranteeing the generation of consistent, transparent and error free GAMS programs.

In addition, the *Agmemod2Gams tool* plays a central role as mediator between the development of the conceptual AGMEMOD model and the development of the computer AGMEMOD model. In general, the procedure works as follows. First, all common exogenous data and specific Russian, Ukrainian and ROW endogenous data is read to create the comprehensive dataset that is required to solve the Russian, Ukrainian, ROW, and the EU model versions. Second, the Russian, Ukrainian and ROW data sets are integrated with the set of equations that has been estimated for the Russian and Ukrainian agricultural commodity markets or calibrated for the ROW model. Then, solutions for all markets, years and countries – including the ROW - are sought and model results are exported to output files. These result files capture the projections of agricultural activity levels (areas harvested, livestock numbers), supply and use balances

(production, domestic use, imports, exports and ending stocks) and prices on Russia, Ukraine, Member States and EU-27 levels.

Figure 46: Procedure from data handling to scenario analysis of Russian model and the stylized ROW modul



Thus in summary, the *Agmemod2Gams tool* is applied in adding the Russian, Ukrainian and ROW modules to the current AGMEMOD framework: it forms the bridge between the data and estimated equations used on the one hand and the Russian, Ukrainian and ROW GAMS modules to be generated on the other hand. It takes care of achieving consistent and transparent GAMS programs in the sense that requirements on use of time indices, bounds and parameter types are fulfilled automatically (Van Leeuwen et al., 2008). Further, it is a handy instrument to validate the model results by adjusting data and equations, generating new GAMS code, solving the models and analysing the results. Ultimately, however, expert knowledge remains the most important basis for interpreting data and model results and providing advice to equip and improve the Russian and Ukrainian AGMEMOD modules.

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Abstract

This report gives an overview on the Russian agri-food sector and provides an outlook for the developments in agricultural markets for Russia, focussing on the main agricultural commodities. For the purpose of the study a detailed dataset and modelling structure for the main agricultural commodities in Russia has been developed and integrated into the overall AGMEMOD modelling framework.

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